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COURSES OF READING AND STUDY

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THE NEW INTERNATIONAL ENCYCLOPÆDIA

SECOND EDITION

COURSES OF
READING AND STUDY

NEW YORK
DODD, MEAD AND COMPANY

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Preface

THE purpose of the present volume, as its name suggests, is to offer help towards self-instruction in the various arts and sciences, utilizing the *New International Encyclopædia* as a general text-book. There is little need to emphasize in this place the rôle of popular educator played by a work like the Encyclopædia. This has been long recognized; and, from a mere work of reference consulted at odd moments for fragments of information, the modern Encyclopædia has become in thousands of homes a source of common culture, the basis of a thorough training in the principles and facts of History, Law, Literature, the Fine Arts, Religion, Biology, Engineering, Physics, Chemistry, or Agriculture. Especially where access to large libraries is difficult or impossible, its value is apparent. In every department of human knowledge, it speaks with a copiousness unequalled in the average text-book and a degree of authority attainable only when every department, and subdivision of a department, is covered by an acknowledged specialist in the field.

A glance at any chapter in the book will show the method pursued. The aim has been to make every chapter a complete summary of the subject with which it deals by arranging the material as the reader or student would find it arranged in a systematic treatise on the subject. The amount of text in each chapter has necessarily been reduced to a minimum, only so much being given as is essential to trace the connection between the successive groups of titles. But, when it is considered that every title in every group represents from two or three hundred to fifteen thousand words of text, the completeness of treatment will be realized.

Within the chapter the material has been divided and subdivided in such a manner as to facilitate study on special topics. If the reader, for instance, desires to make himself particularly well acquainted with a certain period in American History, he need but turn to the proper section in Chapter I., where the subject of American History is outlined in five sub-headings with as many groups of titles; and at the end of the section on American History he will find a list of authorities in whose works he may carry on supplementary reading to any extent. In the same manner, a person interested in the ceremonial or hymnology or clerical vestments of the Roman Catholic Church will find these topics treated in related groups of titles as a section in the chapter on Religion. Under Chemistry one may study the entire subject, carefully outlined for such a purpose, or may concentrate on the acids or the salts or the fats. In every chapter, the technical exposition is supplemented by comprehensive lists of biography wherein the historical aspect of the subject finds complete treatment.

In quoting titles in the lists, the form given is that, of course, which appears in the Encyclopædia; as, CRUELTY TO CHILDREN, PREVENTION OF; or, MACHINERY, ECONOMIC EFFECTS OF. Where reference is made to a long article, the particular section is indicated; as, "See section *The Renaissance* under SCULPTURE," in which case, the reader will turn to Sculpture in the Encyclopædia. In the biographical

titles, the full Christian name, or the corresponding initials, is given as a rule; as ADAMS, SAMUEL; ADAMS, H., KIPLING. The alphabetic arrangement of titles in the Encyclopædia makes reference to volume and page obviously superfluous.

It is in its orderly marshalling of the material contained in the Encyclopædia that we believe the value of this book consists. It is quite unlikely that the average reader, left to his own guidance, will plan his course in such a manner as to produce the fullest results with the least waste of time. Where the subject is unfamiliar, he is as apt at the start to hit upon the middle of it as upon the beginning, and, in passing from article to article, there is always the danger of his missing the logical sequence of topics. A mere index would here be useless. What is necessary is a carefully planned outline that shall lead the reader, step by step, from elementary principles to the most specialized treatment. Such a guide this Outline aims to be.

The preparation of this volume, carried on under the supervision of the Editors, has been in the direct charge of Mr. SIMEON STRUNSKY, of the staff of the *New International Encyclopædia*, and the supervision of the revision for the second edition under the charge of Mr. IRWIN SCOFIELD GUERNSEY.

—THE EDITORS.

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Chapter 1. History

HISTORY, which we may define as the record of man's life on earth and the sum of his achievements, would include in its broadest aspect the entire story of human development from Palæolithic man to the present day. As a matter of convenience, however, in this book we shall leave the beginnings of associated human life to be treated under the heading of Anthropology and Ethnology, where, too, will be found the material for the stories of those peoples and tribes which to the present day have remained without the pale of our civilization. Here we shall take up the narrative at a point in time when we first catch a glimpse of the nations whose culture, evolved during thousands of years, and passed on from hand to hand, has become the heritage of the present day. The traditional division into Ancient, Mediæval, and Modern history is followed, and in accordance with custom the account begins with the nations of the Mesopotamian region, and passes on through Persia and the empire of Alexander into Rome, where also the course of Egyptian, Jewish, Phœnician, and Greek history, taken up in turn, leads us. With Rome, Ancient history ends. India, China, and Japan, though their history goes back to a past coeval with the period we call ancient, are treated apart because of their far less intimate connection with the civilization of Europe, wherein our interest is centered. Mediæval history takes up the story at the fall of Rome, traces the amalgamation of the old world with the new, the growth of the Church, the rise of States, and the transition, through inward development and outward contact with Asia and America, to modern times. There European history becomes largely the story of nations and their conflicts. One by one due treatment is accorded them, the field widening as Australia, Africa, and Asia come within the scope of European interests. The record ends with a section on the history of the United States outlined with greater detail than the account of other lands.

First some conception of the methodology of historical writing and a bird's eye view of the history of the world may be useful, for which see:

History
Asia
Europe

Africa
America
Australia

A. Ancient History

1. BABYLONIA, ELAM, AND ASSYRIA.

Archæological research has carried back the origin of Sumerian and Akkadian civilization to the fifth millennium B. C., given us a fairly continuous history of Babylonia, Elam, and

Assyria, and revealed something of the literature, science, art, laws, and social life of these countries. Babylonia was ruled at times by Gutians, Elamites, Kassites, Assyrians, and Chaldeans, but always exercised a power-

ful cultural influence. The Assyrians established an empire that finally included Elam, Mesopotamia, Syria, and Egypt. A part of it fell to the Chaldæan kingdom, which was conquered by Cyrus in 539 B. C. See:

(a) For the Land:

Mesopotamia
Euphrates
Tigris
Babylonia
Assyria
Arrapachitis
Adiabene
Shinar
Elam

(b) For the Cities:

Nippur
Babylon
Calah
Ur
Erech
Nineveh
Assar
Khorsabad

(c) For the Kings:

Sargon
Hammurapi
Shalmaneser
Tiglath-pileser
Asurnazirpal
Sennacherib
Esarhaddon
Sardanapalus
Nabonassar
Nabopolassar
Nebuchadnezzar
Belshazzar
Cyrus

(d) For the People, Religion, and Language:
Sumerian Language

Chaldæans

Kassites

Amorites

Mitannians

Merodach

Ishtar

Semitic Languages

Babylonian Art

Assyrian Art

Cuneiform Inscriptions

(e) For the Historians and Investigators:

Botta, P. E.
Delitzsch, F.
Layard, A. H.
Meyer, E.
Oppert, J.
Rassam, H.
Rawlinson, H. C.
Sayce, A. H.
Schrader, E.
Smith, G.
Winckler, H.

2. EGYPT.

From the monuments it is evident that the Egyptian civilization was in its origin independent of the Babylonian and goes back to as early an antiquity. From primitive times when the land was divided into two sections, the Delta and the South, we pass through many dynasties of pyramid and temple building kings to a time of subjugation by foreign invaders, of conquests in Palestine and Asia Minor, of decline, and of reduction by the Persians, by Alexander of Macedon, and by Rome. A cheerful people, influenced greatly by their priests, submissive to their kings, worshipping many gods and animals, they left behind them massive structures of which we have not yet the secret. Their

priests read the stars and knew geometry, speculated on the soul, and probably passed on to the Phœnicians the alphabet which was to be ours. (?— B. C. 30) See:

(a) For the Land:

Egypt
Nile
Delta
Nubia
Ethiopia
Libya
Suez Canal

(b) For the Cities and Monuments:

Memphis
Tanis
Thebes
Karnak
Luxor
Ramesseum
Pyramid
Rosetta Stone

(c) For the Kings:

Menes
Cheops
Chephren
Amenemhat
Usertesen
Amasis
Amenophis
Thothmes
Hatasu
Rameses
Psammetichus
Necho
Amasis II
Ptolemy
Cleopatra

(d) For the People, Religion, Language, and Culture:

Egypt
Hamites

Hyksos

Rê

Horus

Osiris

Thoth

Athor

Ammon

Apis

Set

Isis

Nephthys

Anubis

Hieroglyphics

Egyptian Art

Egyptian Music

(e) For the Historians and Investigators:

Egyptology
Breasted, J. H.
Brugsch, H. K.
Champollion, J. F.
Lenormant, C.
Lepsius, K. R.
Manetho
Mariette, A. E.
Maspero, G. C. C.
Naville, E. H.
Petrie, W. M. F.
Renouf, P.
Rougé, O. C. E.
Sayce, A. H.
Wilkinson, J. G.

3. PHœNICIA AND ASIA MINOR.

What is now Syria and part of Asia Minor was in the earliest times debatable ground between Egypt and the Mesopotamian monarchies. On the Palestinian coast the Phœnicians, with little territory, developed a splendid industry and commerce and in their ships carried the seeds of Babylonian and Egyptian civilization over the Mediterranean basin. Later, when the

Hyksos were invading Egypt, a people known as the Hittites appear, stout fighters who render a good account of themselves against the Assyrians and Egyptians. Their homes were in Northern Syria and in Eastern Asia Minor, but about B. C. 700 they disappeared, leaving little trace behind them. See:

(a) For the Phœnicians:

Phœnicia
Sidon
Tyre
Acre
Byblos
Cyprus
Carthage
Hiram
Melkarth
Astarte
Phœnician Art
Amarna Letters

(b) For the Hittites:

Hittites
Syria
Boghaz-Keui
Eyuk
Mitannians
Cappadocia
Carchemish
Marash
Hamath

4. THE JEWS.

The Jews form the third in the group of peoples lying between Egypt and Babylonia and affected by the influence of both. The Hebrews, a Semitic tribe of nomads, after wandering through the land of Canaan, enter the land of Goshen, a territory belonging to Egypt, are there held in bondage, and, hammered into a nation by

persecution, escape, conquering for themselves the land of Canaan and passing thereby from the nomad into the agricultural stage. See:

Jews
Palestine
Goshen
Semitic Languages
Abraham
Isaac
Jacob
Esau
Amarna Letters
Exodus
Moses
Aaron
Joshua
Canaan
Simeon
Judah
Levi
Gad
Naphtali
Issachar
Dan
Zebulun
Ephraim
Benjamin

Ruled by warrior leaders for a long period, the people finally obtain a king, but after a hundred years the nation breaks into two, the northern, Israel, falling to Assyria, the southern, Judah, 150 years later to Babylonia. The Babylonian exiles return and re-establish the Jewish state in the form of a theocracy based on a purified Yahwe worship. See:

Jews
Saul
David
Jerusalem
Solomon

Judah
 Jeroboam
 Joash
 Abimelech
 Jehosaphat
 Ahab
 Josiah
 Hezekiah
 Samaritans
 Babylonia
 Nehemiah
 Ezra
 Cyrus
 Amorites
 Philistines
 Aramæans
 Ammon
 Moab
 Edom
 Judges, Book of
 Kings, Books of

Pharisees
 Zealot
 Essenes
 Zadokites
 Messiah
 Bar-Kokba
 Spain
 Crusades
 Anti-Semitism
 Zionist Movement

(b) For the Law, Language, Literature, and Science:

Bible
 Pentateuch
 Talmud
 Gemara
 Mishna
 Cabbala
 Halacha
 Haggada
 Midrash
 Maimonides
 Yiddish

(c) For the Historians:

Josephus, Flavius
 Ewald, G. H.
 Wellhausen, J.
 Renan, E.
 Graetz, H.

The reëstablished State passes from the suzerainty of Persia to that of Macedonia, the Seleucid kings of Syria, and Rome, rising against whom, Jerusalem is taken (A. D. 70), the Temple destroyed, and the greater part of the nation scattered over the Roman world. The insurrection of Bar-Kokba in the second century is the last forcible assertion of the national spirit. The Jews now enter upon their historic rôle of wanderers, subject alternately to persecution and favor at the hands of rulers and peoples, and held together as a folk by the Law and the Talmud. See:

(a) Jews

Babylonish Captivity
 Antiochus
 Maccabees
 Herod
 Sadducees

5. PERSIA.

In northeastern Iran, a people, the Medians, shake off the yoke of Assyria in the eighth century B. C. and soon attain power over their former masters, but fall themselves under the domination of the Persians and Cyrus, who brings under his sway all of Mesopotamia and Palestine. Under his successors Persia becomes the greatest empire of pre-Alexandrian times, spreads to the Mediterranean, and enters Egypt, but fights vainly against the Greeks and is conquered by the young

hero of Macedon. The empire falls apart, the heart of it, Persia proper, passing in turn to the Parthians, Arabs, Turks, Mongols, and Turks again, till it remains what it is at the present day, a piece in the game between England and Russia in Asia. See:

(a) For the Land and the People:

Iran
Media
Persia
Asia Minor
Bactria
Parthia
Armenia
Susa
Persepolis
Ctesiphon
Ecbatana

(b) For the Dynasties and Kings:

Achæmenidae
Seleucidae
Arsacidae
Sassanidae
Abbasides
Samani and Dilemi
Ghaznevides
Ghuri
Seljuks
Astyages
Cyrus
Cambyses
Darius
Xerxes
Artaxerxes
Khosru
Hulaku Khan
Timur
Abbas I.
Nadir Shah

(c) For the Culture:

Persian Art

Persian Language
Persian Literature

6. GREECE.

The seeds of culture brought to Greece by the Phœnicians from Babylon, Egypt, and Asia Minor, developed into a new civilization, the highest in many respects the world has as yet seen, which influenced mightily the history of future ages. The legendary accounts, in the tales of heroes and gods, probably reflect historical conditions. See:

Mythology
Danaüs
Cadmus
Hercules
Theseus
Minos
Argonauts
Trojan War
Agamemnon
Ulysses
Achilles

Greek history begins with a succession of great migrations from the mainland eastward towards Asia Minor. When authentic history begins, Greece appears as an agglomeration of small independent states, in a state of transition from the monarchical form of government into tyrannies, oligarchies, and democracies. See:

(a) For the Land:

Greece
Asia Minor
Crete
Thessaly
Bœotia
Epirus
Attica
Peloponnesus

Eubœa
Lesbos
Chios
Ithaca
Pydnus
Olympus
Delos

(b) For the Cities:

Athens
Sparta
Thebes
Mycenæ
Tiryns
Argos
Corinth

(c) For the People:

Archæology, II
Hellenes
Danai
Dorians
Ionians
Æolians
Achæans

(d) For the Men:

Lycurgus
Solon
Pisistratus
Clisthenes

The Greeks, after a long, successful struggle against Persia, won national greatness. Democratic Athens first takes the lead among the Greek city states and for a half century plays a brilliant part, then succumbs to Sparta, which in turn falls before Thebes. Disunion brings Greece under the sway of Macedon, whose young king, Alexander the Great, conquers Persia and Egypt and spreads the Hellenic culture in his new realm. Greece proper is ruled by Macedon till it falls with Macedon under the power of Rome. See:

Greece
Athens
Miltiades
Marathon
Themistocles
Salamis
Thermopylæ
Aristides
Leonidas
Ephialtes
Pericles
Conon
Nicias
Sparta
Syracuse
Lysander
Agésilas
Antalcidas
Pausanias
Epaminondas
Pelopidas
Mantineia
Leuctra
Macedon
Philip II
Demosthenes
Æschines
Alexander the Great
Chæronea
Antipater
Demetrius Poliorcetes
Ætolian League
Achæan League
Philopœmen
Pydna
Cynoscephalæ

In the Greek city states the problems of democracy were well worked out, and politics became an exact science. The principles of democracy were carried over the basin of the Mediterranean and the Black Sea, wherever the Greeks, the successors of the Phœnicians as traders and colonizers, went. See:

(a) For Greek Government:

Monarchy
 Tyrant
 Democracy
 Aristocracy
 Despot
 Ecclesia
 Areopagus
 Ostracism
 Boule
 Ephori
 Archon
 Solon
 Lycurgus
 Lysander

(b) For the Greek Colonies:

Ionia
 Mitylene
 Ephesus
 Halicarnassus
 Chalcidice
 Colchis
 Chersonesus
 Cyrene
 Sicily
 Magna Græcia
 Marseilles

Over all the Greek world the Hellenic culture prevailed as in the home country. See:

Architecture, Greece
 Greek Language
 Greek Literature
 Greek Music
 Greek Art
 Greek Philosophy

The Greek religion passed from an unrestrained polytheism into an anticipation of monotheism on the part of the select few, into gross superstition on the part of the many. See:

Olympus
 Pantheon

Jupiter
 Juno
 Apollo
 Mercury
 Vulcan
 Ceres
 Venus
 Diana
 Mars
 Minerva
 Neptune
 Pluto
 Greek Religion
 Greek Festivals
 Games
 Olympic Games
 Mysteries

For the Historians:

Herodotus
 Thucydides
 Xenophon
 Plutarch
 Polybius
 Dio Cassius
 Dionysius of Halicarnassus
 Arrianus
 Theopompus
 Diodorus Siculus
 Curtius, E.
 Finlay, G.
 Grote, G.
 Schliemann, H.

7. ROME.

Greek civilization was imposed on the peoples of Europe, Northern Africa, and Western Asia by the armies of Rome, whose origin goes back to a settlement of Latin outlaws and shepherds on one of the seven hills south of the Tiber. A legendary kingdom gives way, about the beginning of the sixth century B. C., to a republican

form of government. A long contest between privileged and non-privileged classes results in the elaboration of a splendidly efficient system of municipal government. See:

(a) For the Land and the People:

Rome
Italy
Latium
Italic Languages
Latini
Etruria
Samnites

(b) For the Cities:

Rome
Alba Longa
Veii
Tarentum
Capua
Naples
Brindisi
Pompeii
Herculaneum

(c) For the Kingship and the Struggle between Classes:

Romulus
Numa Pompilius
Tarquinius
Comitia
Patrician
Plebeians
Consul
Tribune
Prætor
Censor
Ædiles
Senate
Decemviri
Hortensius
Licinian Rogations

conquest and by means of her splendid military art and unscrupulous diplomacy makes herself mistress of Latium, of Italy, and, after a struggle with Carthage, with Macedonia, and with Syria, of the Mediterranean basin. Unchecked power, however, brings corruption within the State, republican institutions tend to become empty forms, factional strife breaks out, the Senate rules for a while and then succumbs to the ambition of masterful politicians; in the conflict of parties the Republic meets its end. See:

Gaul
Camillus
Pyrrhus
Carthage
Punic Wars
Hamilcar
Hasdrubal
Hannibal
Hispania
Cannæ
Zama
Scipio
Macedonia
Antiochus
Gracchus
Agrarian Laws
Jugurtha
Marius
Sulla
Pompeius
Mithridates
Cicero
Catiline
Cæsar
Cassius
Brutus
Crassus
Antonius
Cleopatra
Actium

With her internal problems settled, Rome enters upon a career of foreign

The Roman Empire, established by Augustus before the beginning of the present era, attained its greatest extent in the early years of the second century of that era and entered on its decline towards the end of the same century. At its height it embraced within its limits the classic world. Peace, excellent means of communication, and an unrivalled administrative system brought the different parts of the Empire close together and facilitated the spread of Greek culture and later of Christianity. The decline of the Empire, due to the decay of old age and the onset of the barbarian tribes of Northern Europe, is arrested by the reforms of Diocletian and of his successor Constantine the Great, who, in the beginning of the fourth century, makes Christianity the State religion. See:

Augustus
Tiberius
Caligula
Claudius
Nero
Vespasian
Titus
Domitian
Trajan
Hadrian
Antoninus Pius
Aurelius
Commodus
Severus, Septimius
Caracalla
Severus, Alexander
Aurelianus
Diocletian
Prætorian Guard
Constantine the Great
Christianity

After Constantine the decline is pre-

cipitate. The ancient Roman prowess is gone, and the defence of the Empire is entrusted to barbarian mercenaries; the task of government becomes too heavy for one man, and the Empire is divided in two. The wave of barbarian migration breaks with full force upon the Western Empire, and the last emperor of Latin Rome is dethroned in 476. See:

Migration
Parthia
Julian
Theodosius
Stilicho
Alaric
Attila
Huns
Goths
Vandals
Burgundians
Odoacer
Ravenna
Honorius
Augustulus
Aëtius

The Romans were preëminent for their political genius; their literature, in part, their philosophy, and their art were copies of the Greek, and the general culture at the time of the Empire's zenith was Hellenistic; their gods, too, were largely borrowed or adapted from the Greek pantheon; but in administration and law they were unexampled innovators and in these fields they influenced subsequent European civilization mightily. See:

(a) For the Religion:

Roman Religion
Jupiter
Janus
Mars

- | | |
|-----------------------------------|-------------------------|
| Quirinus | Papinianus |
| Vesta | Paulus |
| Auguries and Auspices | Pandects |
| Flamens | (d) For the Historians: |
| Lupercalia | Ammianus Marcellinus |
| Salii | Annals |
| (b) For the Language and Culture: | Appianus |
| Italic Languages | Eutropius |
| Latin Language | Ferrero, G. |
| Latin Literature | Gibbon, E. |
| Roman Art | Ihne, W. |
| Philosophy | Livy |
| (c) For Administration and Law: | Merivale, C. |
| Civil Law | Mommsen, T. |
| Justinian | Niebuhr, B. G. |
| Twelve Tables | Sallust |
| Jus Gentium | Suetonius |
| Municipality | Tacitus |

B. Mediæval History

1. The East Roman or Byzantine Empire continued to exist for a thousand years. Within the limits of the Western Empire the Germanic tribes settled as masters, and from their gradual amalgamation with the conquered Roman provincials date the beginnings of the modern peoples of Europe. The most powerful of the barbarian kingdoms, that of the Franks, attained imperial extension under Charles the Great, who, by his alliance with the Pope, established the connection between Empire and Church, which was to become one of the most powerful determinants of events in the Middle Ages. See:

- (a) For the Migrations:
Migration

Britannia
Angles
Saxons
Jutes
Gaul
Burgundians
Franks
Hispania
Suevi
Vandals
Italy
Goths
Theodoric
Lombards
Saracens

- (b) For the East Roman Empire:
Byzantine Empire
Justinian
Belisarius
Narses

(c) For the Frankish Empire:

Clovis
 Merovingians
 Carolingians
 Brunhilda
 Fredegunda
 Charles Martel
 Pepin the Short
 Donation of Pepin
 Charles the Great
 Papal States
 Salic Law

2. On the death of Charles the Great the Frankish Empire falls apart. Two great kingdoms arise, France and Germany. The Germans make their power supreme in Central Europe and in Italy, and a German king is crowned Holy Roman Emperor, reviving the connection between Church and State established by Charles the Great. A second Teuton stock, the Northmen, appear as conquerors in France, England, Italy, and Russia. The growth of nations proceeds rapidly, and from the relations between conqueror and conquered develops Feudalism. The young nations are brought into conflict with the growing power of the Church, which, under the leadership of the Bishop of Rome, seeks to raise the ecclesiastical power above the secular. The break-up of the Mediæval ages begins with the Crusades. See:

(a) For the Growth of Nations:

Franks
 Verdun, Treaty of
 France
 Neustria
 Germany
 Austrasia
 Franconia
 Swabia

Alemanni
 Otho the Great
 Holy Roman Empire
 Normans
 Normandy
 Varangians
 England
 William the Conqueror
 Italy
 Sicily
 Guiscard
 Russia

(b) For Mediæval Society:

Feudalism
 Feud
 Livery
 Homage
 Knight
 Chivalry
 Esquire
 Heraldry
 Serf
 Ordeal
 Truce of God
 Compurgation

(c) For the Struggle between Church and State:

Gregory VII
 Investiture
 Hohenstaufen
 Guelphs and Ghibellines
 Henry IV of Germany
 Henry V of Germany
 Papacy
 Innocent III
 Philip II of France
 Philip IV of France
 John of England
 Henry II of England
 Frederick I Barbarossa
 Frederick II of Germany

(d) For the Crusades:

Crusades

Papacy
 Hospitalers
 Templars
 Teutonic Knights
 Peter the Hermit
 Urban II
 Godfrey de Bouillon
 Bohemund
 Tancred
 Baldwin
 Antioch
 Richard I of England
 Saladin
 Venice
 Dandolo
 Louis IX of France
 Latin Kingdom of Jerusalem

3. The Crusades were followed by a great increase in the commerce of Western Europe and the rise of an influential burgher class, with whose aid the kings succeeded in making themselves independent of the feudal nobility. With the growth of centralized kingdoms the power of the Papacy declines. Contact with the East and the ancient world stimulated the European mind, and the Revival of Learning, the succession of great geographical and astronomical discoveries, and the invention of gunpowder and printing hasten the transition from the Middle Ages to modern times. The uniformity of European society, characteristic of the Middle Ages, is broken up by the Reformation. See:

(a) For Commerce, Discoveries, and Inventions:

Hanseatic League
 Gunpowder
 Printing
 Copernicus
 Columbus

Gama, Vasco da
 Venice
 Genoa
 Henry the Navigator
 Africa
 America

(b) For the Decline of the Papacy:

Boniface VIII
 Avignon
 Schism, Great
 Constance, Council of
 Basel, Council of

(c) For the Revival of Learning and the Renaissance:

Petrarch
 Bracciolini
 Guarino
 Poliziano
 Lorenzo de' Medici
 Erasmus
 Colet
 Grocyn
 Linacre
 More, Thomas
 Reuchlin
 Hutten, Ulrich von
 Epistolæ Obscurorum Virorum
 Renaissance Art

(d) For the Reformation:

Reformation
 Wiclif
 Huss
 Luther
 Charles V
 Augsburg Confession
 Melancthon
 Schmalkaldic League
 Zwingli
 Calvin
 Huguenots
 Henry VIII of England
 Wishart
 Knox

Counter-Reformation
Trent, Council of
Thirty Years' War

For the Historians:

Creighton, M.
Denifle, F. H.
Emerton, E.
Fisher, G. P.

Fleury, Claude
Gieseler, J. K.
Hallam, H.
Harnack, Adolf
Hefele, K. J.
Lea, H. C.
Neander, J. A.
Pastor, L.

C. Modern History

At the opening of the modern era the process of State formation in Europe had resulted in the establishment of firmly centralized nations in England, France, and Spain. Germany and Italy, on the contrary, were disunited, and destined so to remain till the later years of the nineteenth century. The conflicts of States and nationalities is one of the great features of modern times; till 1648 religion is a fruitful cause of external warfare and civil strife; after 1648 wars are fought on political and commercial grounds. The disappearance of a common Church and of Latin as the common vehicle of communication among the higher classes tended to intensify the differentiation of national characteristics. The burgher class, which had begun to assert itself in the period after the Crusades, rose to full recognition in the life of the State and in turn was forced to render recognition, after the French Revolution, to the lowest classes in the State, artisans and peasants. The Church loses control over the temporal affairs of its members, and even in the spiritual field its authority is subordinated to that of the State. Life takes on a predominantly secular tinge; science broadens the intellectual horizon,

and commerce and colonization bring the non-European part of the Eastern Hemisphere within the sphere of European influence. The history of modern times is best studied in the history of the various nations.

1. ENGLAND.

The Britannia of the Romans is overrun in the age of migrations by Teutonic tribes from Jutland and the northwest of Germany, who, receiving a new infusion of kindred blood from the Danes, are conquered in the eleventh century by a more remote kinsfolk, the Normans—Gallicized Teutons from France. Saxons and Normans are blended into one before 1400, by which time a constitutional system of government, worked out in the course of long conflicts between rulers and subjects, is in force, based on the supreme legislative authority of a Parliament, representing the different estates. Wales and Ireland have been subdued, and Scotland has ceased to be a dangerous rival. Feudalism, never so strong in England as on the Continent, is practically destroyed during the Wars of the Roses in the fifteenth century, and the modern era may be dated from the accession of the Tudors in 1485. See:

England
 Britannia
 Anglo-Saxons
 Heptarchy
 Alfred
 Edward the Confessor
 Canute
 Harold
 Witenagemot
 William the Conqueror
 Hastings, Battle of
 Hereward
 Domesday Book
 William II
 Henry I
 Stephen
 Plantagenet
 Henry II
 Becket
 Ireland
 English Pale
 Richard I
 John
 Magna Charta
 Oxford, Provisions of
 Montfort, Simon de
 Edward I
 Parliament
 Wales
 Llewellyn ap Griffith
 Scotland
 Wallace
 Bruce
 Bannockburn
 Edward II
 Mortimer, Roger de
 Edward III
 Hundred Years' War
 Crécy
 Poitiers
 Black Death
 Richard II
 Tyler's Rebellion
 Ball, John

Wiclif
 Provisors, Statute of
 Præmunire
 Mortmain, Statutes of
 Lancaster, House of
 Henry IV
 Agincourt
 Henry VI
 York, House of
 Margaret of Anjou
 Cade, Jack
 Roses, Wars of the
 Edward IV
 Warwick, Earl of
 Richard III
 Tudor

Under the Tudors the power of Parliament greatly declined. The Reformation, initiated by Henry VIII, soon spread beyond the limits the King would set to it, and England became Protestant. Under Elizabeth it was forced to contend against Spain, the champion of Catholicism. With the defeat of Spain, England enters on her career as ruler of the seas and begins the work of founding a new English-speaking nation across the Atlantic. The death of Elizabeth, the last of the Tudors, gives England and Scotland a common sovereign. A revived Parliament asserts its rights successfully against the absolutism of the Stuarts, dethrones them, recalls them, and drives them as enemies of Protestantism once more from the throne, bestowing the crown upon a prince of Dutch blood. The crowns of England and Scotland are united. On the Continent, England takes a leading part in the overthrow of Louis XIV of France and comes out of the struggle more powerful than ever upon the seas. See:

Henry VII

Parliament
 Star Chamber
 Benevolence
 Henry VIII
 Boleyn, Anne
 Wolsey, Cardinal
 Cromwell, Thomas
 Reformation
 Cranmer
 Edward VI
 Mary I
 Ridley
 Latimer
 Elizabeth
 Supremacy
 Mary Stuart
 Burleigh
 Walsingham
 Leicester
 Essex
 Armada
 Drake
 Howard
 Stuart
 James I
 Charles I
 Petition of Rights
 Ship-Money
 Strafford, Earl of
 Laud
 Long Parliament
 Grand Remonstrance
 Five Members
 Pym
 Eliot
 Hampden
 Cromwell, Oliver
 Vane, Henry
 Blake
 Fairfax
 Ireton
 Scotland
 Covenants
 Presbyterianism

Montrose, Earl of
 Charles II
 Clarendon, Earl of
 Cabal
 Test Acts
 Oates, Titus
 Shaftesbury, Earl of
 James II
 Halifax, Earl of
 William III
 Mary II
 Anne
 Succession Wars (*Spanish*)
 Utrecht, Treaty of
 Marlborough, Duke of
 Bolingbroke
 Harley
 Sacheverell

With the accession of the House of Hanover, the supremacy of Parliament is firmly established; cabinet government is developed, and the rule of party is the order—by the Whigs, roughly speaking, to the French Revolution, by the Tories to 1832, by the two or their successors since then, in comparatively rapid alternation. France is defeated and deprived of her Indian and American possessions, but almost immediately England suffers an irreparable loss in the defection of the thirteen colonies. Partial compensation, however, is found in India, where English adventurers build up a new empire. After the French Revolution and the Napoleonic Wars, comes strife between the advocates of reaction and the rising forces of democracy, stimulated by the great industrial revolution. The latter win in 1832, and the subsequent history of England is one of democratic progress within, of conquest and commercial expansion abroad. See:

United Kingdom
Whig and Tory
George IV
Cabinet
South Sea Company
Walpole, Robert
Newcastle, Duke of
Chatham, Earl of
Seven Years' War
Bute, Earl of
Grenville
Townshend
Wilkes, John
North, Lord
Fox, Charles James
Pitt, William
Burke, Edmund
Sheridan, R. B.
Trafalgar
Nelson
Wellington
Peninsular War
Canning
India
Clive
Hastings, Warren
Wellesley, Marquis
Cornwallis, Lord
Dupleix
William IV
Peterloo Massacre
Trade Unions
Russel, Lord John
Grey, Earl (1st, 2d and 3d)
Victoria
Corn Laws
Peel, Robert
Cobden, John
Bright, John
Palmerston, Lord
Derby, Earl
Disraeli
Gladstone
Salisbury, Marquis of

Rosebery, Earl of
Chamberlain, Joseph
Balfour, Arthur
Beresford, Lord C.
Campbell-Bannerman
Law, A. Bonar
Morley, Viscount
Ireland
Tyrconnel
Stewart, Robert
Home Rule
Roman Catholic Emancipation
O'Connell, Daniel
Irish Land Laws
Fenian Society
Redmond, J. E.
Parnell, Charles Stewart
Australia
Canada
Imperial Federation
Edward VII
South African War
French, Sir J. W.
Union of South Africa
War in Europe
Asquith, H. H.
Lloyd-George, D.
Kitchener of Khartum
George V
Churchill, W. S.
Curzon, Earl

For the Historians:

Acton, J. E. E. D.
Bury, J. B.
Clarendon, Lord
Elphinstone, M.
Firth, C. H.
Freeman, E. A.
Froude, J. A.
Fyffe, C. A.
Gairdner, J.
Gardiner, S. R.
Geoffrey of Monmouth

Gildas
 Giraldus de Barri
 Green, J. R.
 Gross, C.
 Gwatkin, H. M.
 Hallam, H.
 Holinshed, R.
 Kinglake, A. W.
 Kingsford, W.
 Lappenberg, J. M.
 Lecky, W. E. H.
 Lingard, J.
 Macaulay, T. B.
 McCarthy, Justin
 Maitland, F. W.
 Napier, W. F. P.
 Oman, C. W. C.
 Palgrave, F.
 Paris, Matthew
 Rose, J. H.
 Seebohm, F.
 Stubbs, W.
 Turner, Sharon
 Walpole, Spencer
 William of Malmesbury

2. FRANCE.

Upon the dissolution of the Frankish Empire in the ninth century, descendants of Charles the Great continue to rule over the land of the Western Franks with a population predominantly Celtic and a language derived from the Latin. This is the beginning of France. The weak Carolingians are replaced by the energetic house of Capet, under which the unification of the country is carried on by such able rulers as Philip II, Louis IX, and Philip IV. The Hundred Years' War is disastrous to the kingdom, but its recovery is rapid under Charles VII and his son, Louis XI, who leave the

power of the crown firmly established. Religious wars in the sixteenth century become a factor for anarchy, but feudalism is definitely crushed by Richelieu, and absolutism is established by Louis XIV, under whom France is for fifty years the overweening power in Europe. Absolutism breaks down under Louis XIV's unworthy successors, and the entire ancient fabric of society is swept away by the French Revolution. See:

France
 Brittany
 Normandy
 Burgundy
 Flanders
 Aquitania
 Anjou
 Navarre
 Franks
 Carolingians
 Verdun, Treaty of
 Capetian Dynasty
 Louis VII
 Philip II, Augustus
 Louis IX
 Philip IV, the Fair
 Valois, House of
 Hundred Years' War
 Crécy
 Poitiers
 John II
 Jacquerie
 Charles VI
 Agincourt
 Du Guesclin
 Dunois
 Joan of Arc
 Charles VII
 Louis XI
 Charles the Bold
 Charles VIII

Louis XII
 Francis I
 Henry II
 Huguenots
 Catharine de' Medici
 Guise
 Condé
 Coligny
 Bartholomew's, Massacre of Saint
 Charles IX
 Henry III
 Politiques
 Henry IV
 Nantes, Edict of
 Sully, Duke de
 Louis XIII
 Richelieu
 Westphalia, Peace of
 Mazarin
 Maintenon, Marquise de
 Louis XIV
 Fronde
 Parlement
 Colbert
 Louvois
 Turenne
 Vendôme, Duke de
 Luxembourg, Duke of
 Villars
 Camisards
 Succession Wars
 Orleans, Philippe, Duke of
 Dubois
 Louis XV
 Seven Years' War
 Pompadour, Marquise de
 Du Barry, Countess
 Louis XVI
 Turgot
 Necker
 Farmers-General
 States-General
 The abolition of feudalism by the
 French National Assembly is followed

by the overthrow of the monarchy.
 Assailed by the rulers of Europe,
 France retaliates, and its conquering
 armies carry the gospel of democracy
 over the Continent. Under Napoleon,
 France dominates Europe until, de-
 feated by a rising of the European
 peoples, it is compelled to take back its
 Bourbon kings. Reaction struggles
 with the advancing ideals of political
 and social revolution, and the country
 witnesses within the century the over-
 throw of three dynasties and the estab-
 lishment of two republics. Under
 Napoleon III, France regains for a
 brief period its ascendancy in Euro-
 pean politics, but suffers overwhelming
 defeat at the hands of a new-created
 Germany. Her latest history has to
 do with the slow grounding of repub-
 lican principles, the adjustment of rela-
 tions between Church and State and the
 great war which began in 1914. See:

French Revolution
 Assembly, National
 Mirabeau
 Marie Antoinette
 Bastille
 National Guard
 Lafayette
 Bailly
 Jacobins
 Feuillants
 Cordeliers
 Barnave
 Pétion
 Pillnitz
 Valmy
 Jemappes
 Dumouriez
 Convention, National
 Girondists
 Brissot

Roland de la Platière
 Vergniaud
 Montagnardes
 Marat
 Danton
 Billaud-Varennes
 Carnot
 Callot d'Herbois
 Robespierre
 Saint-Just
 Vendée
 Hébert
 Jourdan
 Pichegru
 Moreau
 Barras
 Directory
 Sieyès
 Talleyrand
 Josephine
 Napoleon I; III
 Masséna
 Ney
 Murat
 Davout
 Junot
 Marmont
 Lannes
 Soult
 Suchet
 Victor
 Beauharnais
 Continental System
 Code Napoléon
 Separation of Church and State
 Louis XVIII
 Charles X
 Louis Philippe
 Guizot
 Thiers
 Ledru-Rollin
 Blanc, Louis
 Eugénie-Marie de Montijo
 Crimean War

Franco-German War
 Bazaine
 Favre, Jules
 Gambetta
 MacMahon
 Ferry
 Boulanger
 Casimir-Périer
 Faure
 Loubet
 Dreyfus, Alfred
 Waldeck-Rousseau
 Delcassé
 Triple Entente
 Freycinet
 Ribot
 Fallières
 Jaurès
 Poincaré
 Viviani
 Briand
 Gallieni
 Joffre
 War in Europe

For the Historians:

Chéruel, P. A.
 Duruy, V.
 Froissart, J.
 Guizot, F. P. G.
 Hanotaux, G.
 Houssaye, H.
 Joinville, Jean
 Lanfrey, P.
 Lavissee, E.
 Luchaire, A.
 Martin, H.
 Michaud, J.
 Michelet, J.
 Mignet, F. A. M.
 Montalembert, C. F.
 Rambaud, A. N.
 Seignobos, C.

Sorel, A.
 Stephens, H. M.
 Sybel, H.
 Thierry, Amédée
 Thierry, Augustin
 Thou, J. A. de
 Villehardouin, Geoffroy de

3. GERMANY.

German history, like the history of France, may be dated from the dissolution of the Frankish Empire. Unlike France, Germany knew no unity until the very latest times. The establishment of the Holy Roman Empire in the tenth century connected the political fortunes of Germany with those of Italy and the Papacy, and the history of the empire is but the history of the separate states within the empire. After 1273, the imperial dignity is held, as a rule, by members of the house of Hapsburg, and the imperial interests become more and more Austrian. Disunion is fostered by the Reformation and perpetuated by the Thirty Years' War. In the eighteenth century, Prussia enters into competition with Austria for leadership in the empire, which, after existing for more than eight hundred years, is dissolved by Napoleon in 1805. The quarrel between Prussia and Austria is fought out in the nineteenth century, and the former triumphs. A new German Empire is formed, differing from the Holy Roman Empire in its national character, and, as the strongest military power on the Continent, occupies a leading place in the European system. See:

Germany
 Prussia
 Bavaria

Saxony
 Württemberg
 Hanover
 Baden
 Verdun, Treaty of
 Franconia
 Swabia
 Lorraine
 Otho I
 Holy Roman Empire
 Henry II, IV, VI
 Conrad II
 Investiture
 Gregory VII
 Hohenstaufen
 Guelphs and Ghibellines
 Frederick I, Barbarossa
 Frederick II
 Hapsburg
 Rudolph I
 Austria-Hungary
 Charles IV, V, VI
 Golden Bull
 Electors
 Sigismund
 Maximilian I
 Aulic Council
 Reformation
 Passau, Treaty of
 Bohemia
 Thirty Years' War
 Leopold I
 Pragmatic Sanction
 Frederick William I, III, IV
 Frederick II
 Maria Theresa
 Succession Wars (*Austrian*)
 Seven Years' War
 Francis II of Austria
 Stein
 Scharnhorst
 Blücher
 Gneisenau
 Leipzig, Battles of

Waterloo
 Vienna, Congress of
 Metternich
 Burschenschaft
 Zollverein
 Frankfort, Council of
 Seven Weeks' War
 Bismarck-Schönhausen
 Moltke
 William I
 Kulturkampf
 Triple Alliance
 William II
 Caprivi
 Hohenlohe
 Bülow
 Bethmann-Hollweg
 Jagow
 Hindenburg
 Tirpitz
 War in Europe

For the Historians:

Bulle, K.
 Dahlmann, F. C.
 Dahn, F.
 Droysen, J. G.
 Dümmler, E.
 Erdmannsdörffer, B.
 Gfrörer, A. F.
 Giesebrecht, F. W. B.
 Häusser, L.
 Janssen, J.
 Lamprecht, K.
 Marcks, E.
 Maurenbrecher, W.
 Müller, Johannes
 Oncken, W.
 Ranke, L.
 Raumer, F. L.
 Sybel, H.
 Treitschke, H.
 Waitz, G.

4. AUSTRIA-HUNGARY.

Austria-Hungary is a political unit merely and in no sense a national State, and its history is largely that of the several states that compose it. The relationship to European affairs resulting from the close connection between the house of Austria and the Holy Roman Empire, for five centuries, is best traced under GERMANY, which see. Here, the internal affairs alone will be touched upon, and the history may be summed up in the history of a family, the Hapsburgs, that, starting with small territorial possessions in the Swabian mountains, brought under its sway by conquest or marriage the heart of Central Europe, from the Carpathians to the Alps and from the Vistula to the Danube and the Adriatic Sea. See:

(a) For Austria:

Austria-Hungary
 Bohemia
 Dalmatia
 Styria
 Moravia
 Galicia
 Tyrol
 Carinthia
 Carniola
 Babenberg
 Ottokar II
 Hapsburg
 Rudolph I
 Albert II
 Maximilian I
 Charles V
 Ferdinand I, II
 Maximilian II
 Thirty Years' War
 Succession Wars (*Spanish*)
 Eugène, Prince
 Joseph II

Leopold II
 Campo-Formio
 Lunéville
 Pressburg
 Vienna, Congress of
 Metternich
 Francis II
 Francis Joseph I
 Windischgrätz
 Radetzky
 Lombardy
 Seven Weeks' War
 Ausgleich
 Triple Alliance
 War in Europe

(b) For Hungary:

Hungary
 Arpad
 Báthory
 Louis I, II
 Sigismund
 Hunyady, János
 Matthias Corvinus
 Mohács
 Zápolya
 Tökölyi
 John III, Sobieski
 Rákóczy
 Deák, Ferencz
 Batthyányi
 Kossuth
 Bem
 Dembinski
 Görgey
 Mészáros
 Klapka
 Haynau
 Tisza

(b) For the Historians:

Arneth, A. R.
 Fessler, I. A.
 Gindely, A.
 Hormayr, J.

Krones, F.
 Mailáth, J.
 Zeissberg, H.
 Wolf, Adam

5. THE IBERIAN PENINSULA.

One of the richest regions of the Roman Empire, Hispania, was wrested from the Romans by successive waves of barbarian invaders in the fifth century of our era. The Christian Gothic kingdom was overthrown by the Arabs, who developed in the peninsula a civilization that was long the highest in Europe. The remnants of the Christian inhabitants rallied in the northern mountains and a slow but steady process of reconquest was begun, hastened by the dissolution of the Arab Caliphate, retarded by strife among the various Christian kingdoms, completed before the end of the fifteenth century, when the greater part of the peninsula had been brought under one crown. Portugal alone preserved its independence of Castile. Enriched by the wealth of a newly discovered world and her Lowland possessions, Spain, in the sixteenth century, plays the leading rôle in European affairs and then enters on a course of political and economic decline which has continued to the present day. Portugal and Great Britain have been friends since the beginning of the eighteenth century. See:

(a) For Spain:

Spain
 Iberians
 Phœnicia
 Carthage
 Hispania
 Lusitania

Goths
 Suevi
 Roderick
 Moors
 Tarik
 Ommiads
 Cordova
 Mohammedan Art
 Navarre
 Asturias
 León
 Castile
 Aragon
 Almoravides
 Almohades
 Granada
 Boabdil
 Ferdinand V of Castile
 Isabella I, II
 Ximenes
 Inquisition
 Cortes
 Fuero
 Padilla, Juan
 Alcántara
 Calatrava
 Gonsalvo de Cordova
 Philip II, III, IV
 Armada
 Charles, II, IV
 Succession Wars (*Spanish*)
 Alberoni
 Farnese
 Godoy
 Peninsular War
 Ferdinand VII
 Carlos, Don
 Maria Christina
 Espartero
 Narváez
 Prim
 O'Donnell
 Castelar
 Serrano

Amadeus I
 Alfonso XII, XIII
 Cánovas del Castillo
 Sagasta
 Silvela
 Spanish-American War

(b) For Portugal:

Portugal
 Alfonso I, V
 Diniz
 John I, III
 Henry the Navigator
 Manuel the Great
 Gama, Vasco da
 Almeida
 Albuquerque
 Braganza, House of
 Methuen Treaty
 Pombal
 Peninsular War
 Miguel, Dom
 Pedro, Dom
 Saldanha
 Charles I
 Brazil
 Manuel I, II
 War in Europe

(c) For the Historians, see:

Barros, J. de
 Coxe, W.
 Dozy, R.
 Gayangos
 Lafuente, M.
 Lea, H. C.
 Llorente, J. A.
 Mariana, J.
 Prescott, W. H.
 Robertson, W.
 Zurita Y. Castro

6. ITALY.

The fall of the Western Empire was followed by a struggle between the

Goths and the Byzantines for the possession of Italy. The latter held the south while the north passed from the Goths to the Lombards and the Franks. Constituted with Germany into a shadowy Holy Roman Empire, Italy enters upon a period of utter disunion with the Papal power established in the centre of the peninsula, the north parceled out into independent principalities and republics, the south ruled by Normans, Saracens, French, and Spaniards. The Italian cities rise to great prosperity after the Crusades and become the cradle of the Renaissance. The state of political disintegration continues till the later part of the nineteenth century and Italy suffers from internal strife and foreign domination, Spain and Austria playing the master in the greater part of the peninsula. Union comes to the country from the house of Savoy, whose power, spreading over Sardinia and Piedmont, after a contest with Austria, the Papacy, and Spain, spreads over the entire peninsula. Early Italian history is best studied in the story of separate states and celebrated families. See:

Rome
Venice
Florence
Milan
Genoa
Pisa
Lucca
Verona
Bologna
Ravenna
Ferrara
Naples
Papal States
Two Sicilies, Kingdom of
Sicily

Foscari
Falieri
Malatesta
Medici
Visconti
Colonna
Orsini
Este
Borgia
Theodoric the Great
Belisarius
Narses
Lombards
Saracens
Normans
Guiscard
Crusade
Renaissance
Charles VIII of France
Sforza
Condottieri
Louis XII of France
Ferdinand V of Spain
Julius II (Pope)
Savoy
Napoleon I
Suvaroff
Nelson
Murat
Carbonari
Holy Alliance
Victor Emmanuel I, II, III
Charles Albert
Mazzini
Young Italy
Radetzky
Manin
Cavour
Garibaldi
Villafranca
Rattazzi
Ricasoli
Crispi
Rudini

Depretis
Humbert I
Mafia
Turco-Italian War
Salandra
Sonnino
War in Europe

For the Historians:

Amari, M.
Balbo, C.
Botta, C. G.
Burckhardt, J.
Cantù, C.
Cibrario, G. A.
Farini, L. C.
Gallenga, A.
Gregorovius, F.
Hodgkin, T.
Johnston, R. M.
La Farina, G.
Liudprand
Muratori, L. A.
Paulus Diaconus
Sismondi, J. C.
Symonds, J. A.
Villari, P.

7. THE SLAV EMPIRE.

The Slav inhabitants of the plains south of the Finnish lakes received in the ninth century a ruler of Scandinavian stock, whose successors extended their sway to the southern rivers. The Byzantine civilization and religion are introduced. The unity of the country disappears after the tenth century, and its independence is swept away in the thirteenth by Mongol invaders from the east. The power of the Mongols breaks up in the fifteenth century and a new empire is created by the grand princes of Moscow, whose rule is steadily extended to the south and west at the expense of Poland and the Baltic

powers. Peter I brings Russia within the sphere of European politics and gains for his country a predominant place among the northern powers. With the Baltic reached, Russia turns once more to the south and driving the Turks before her, she reaches the Black Sea and seeks to press into the Balkan peninsula. The jealousy of the powers halts her progress and her advance assumes a new direction—eastward and southward in Asia, where the beginnings of her power had been made in the sixteenth century. In her attack on the integrity of the Chinese Empire, she finds a formidable rival in Japan. Internally, after Peter's time, a struggle goes on between the Eastern and Western civilization, which, at the beginning of the twentieth century, finds Russia still a despotism. Poland, at one time the greatest power in central Europe, fell through disunion and its territory was absorbed by Austria, Prussia, and, to the largest extent, by Russia. See:

(a) For Russia:

Russia
Slavs
Varangians
Rurik
Novgorod
Kiev
Vladimir
Tchernigov
Batu Khan
Alexander Nevski
Moscow
Kiptchak
Ivan III, the Great
Ivan IV, the Terrible
Godunoff, Boris
Demetrius

Romanoff, House of
 Peter I, the Great
 Streltsi
 Charles XII of Sweden
 Anna Ivanovna
 Dolgoruki
 Golitzin
 Biron
 Anna Karlovna
 Elizabeth Petrovna
 Catharine II
 Poland
 Armed Neutrality
 Paul I
 Alexander I
 Tilsit
 Holy Alliance
 Nicholas I
 Crimean War
 Alexander II
 Serf
 Nihilism
 Russo-Turkish War
 Berlin, Congress of
 Loris-Melikoff
 Alexander III
 Ignatieff
 Anti-Semitism
 Nicholas II
 Finland
 Siberia
 Manchuria
 Russo-Japanese War
 Goremykin
 Nicholas (Nikolai Nikolaievitch)
 War in Europe

(b) For Poland:

Poland
 Lithuania
 Teutonic Knights
 Casimir III, the Great
 Jagellons
 Casimir IV

Sigismund the Great
 Ukraine
 Cossacks
 Chmielnicki
 Thorn
 John III, Sobieski
 Succession Wars (*Polish*)
 Stanislas Leszczynski
 Augustus II
 Catharine II
 Kosciuszko
 Chlopicki
 Bem
 Dembinski
 Panslavism
 Aksakoff, I. S.
 War in Europe

For the Historians:

- (a) Bestuzheff-Ryumin, K. N.
 Brückner, A.
 Karamzin, N. M.
 Kostomaroff, N. I.
 Pogodin, M. P.
 Rambaud, A. N.
 Solovieff
- (b) Chodzko, L. J.
 Lelewel, J.
 Niemcewicz, J. U.

8, THE BALKAN PENINSULA.

The Byzantine Empire, successor to the Roman Empire in the eastern Mediterranean, after a thousand years' existence, fell before the Turks, whose power, spreading northward beyond the Danube, extended over Hungary and threatened the Austrian dominions. The rapid decline of the Turks begins with the eighteenth century and has continued to the present day, resulting in the restriction of the Ottoman power to but a fraction of its once vast territories. Russia and Austria have stead-

ily pressed the Turkish power backward, and only the jealousy of the Western powers, England primarily, has preserved the integrity of the Empire. Part of the territory wrested from Turkey has been erected into independent Christian States. In 1908 the Young Turk movement overthrew the old order of things and established a constitutional government. In the Great War Turkey divorced herself from England and cast in her lot with the Teutonic allies. See:

(a) Turkey

Eastern Question
Othman
Amurath I
Janizaries
Bajazet I
Amurath II
Mohammed I
Mohammed II
Mohammed III
Mohammed IV
Mohammed V
Selim I
Solyman
Lepanto
Kiuprili
Kara Mustapha
Eugène, Prince
Mahmud II
Mehemet Ali
Crimean War
Abd ul-Aziz
Abd ul-Hamid
Russo-Turkish War
Berlin, Congress of
Greece
Crete
Armenia
Albania
Ali Pasha
Macedonia

Darius

Russo-Turkish War

*Crimian War
Congress of Berlin*

Adrianople
Constantinople
Abd ul-Medjid
Turco-Italian War
Balkan War
War in Europe

(b) Greece

Hetærae
Coray
Ypsilanti
Mavrocordatos
Miaulis
Kanaris
Bozzaris
Kolokotronis
Capo d'Istria
Navarino
Otto I
George I
Trikoupis
Delyannis
Trikoupis, C.
Constantine I
Balkan War
Venizelos
Zaimis
War in Europe

(c) Servia

Czerny George
Obrenovitch
Alexander Karageorgevitch
Milan I
Natalie
Ristic
Alexander I
Peter I, Karageorgevitch
Skupshtina
Bosnia
Herzegovina
Berlin, Congress of
Panslavism
Balkan War
Pashich

War in Europe
Mijatovich

- (d) Bulgaria
 - Bulgars
 - Russo-Turkish War
 - Alexander I
 - Ferdinand I
 - Stambuloff
 - Berlin, Congress of
 - Balkan War
 - Panslavism
 - War in Europe
- (e) Rumania
 - Moldavia
 - Wallachia
 - Kantemir
 - Hospodar
 - Fanariots
 - Ypsilanti
 - Ghika
 - Russo-Turkish War
 - Jews
 - Berlin, Congress of
 - Bratianu
 - Charles I
 - Balkan War
 - Panslavism
 - Ferdinand (Rumania)
 - War in Europe
- (f) Bosnia
- (g) Herzegovina
- (h) Montenegro
 - Berlin, Congress of
 - Danilo I
 - Panslavism
 - Balkan War
 - Scutari
 - Nicholas I
 - War in Europe
- (i) Albania
 - Balkan War
 - Essad Toptani

William of Wied
War in Europe

For the Historians:

Creasy, E. S. (Turkish)
 Hammer-Purgstall (Turkish)
 Lambros (Greek)
 Trikoupis, S. (Greek)
 Ranke, L. von. (Servian)
 Mijatovich, C. (Servian)
 Jirecek, K. (Bulgarian)
 Iorga, N. (Rumanian)

8. THE MINOR NATIONS OF EUROPE.

(a) Denmark

Margaret
 Christian VII
 Christian VIII
 Christian IX
 Christian X
 Schleswig-Holstein
 Frederick III
 Frederick V
 Frederick VI
 Frederick VII
 Frederick VIII
 Norway
 Oscar II
 War in Europe

(b) Sweden

Finland
 Eric
 Kalmar
 Sture
 Gustavus Vasa
 Charles IX
 Gustavus Adolphus
 Oxenstierna
 Christina
 Charles XII
 Gustavus I-V
 Caps and Hats
 Charles XIV, John

Oscar I, II
 Adolphus Frederick
 War in Europe

(c) Norway

Normans
 Harald Haarfagr
 Iceland
 Haakon
 Denmark
 Christian II, IV, VII
 Frederick I, II
 Haakon VII
 Olaf
 War in Europe

(d) Netherlands

Burgundy
 Granvella
 Margaret of Parma
 William the Silent
 Egmont
 Hoorne
 Alva
 Farnese, Alexander
 Barneveldt
 Maurice of Nassau
 Dort, Synod of
 De Witt
 Stadtholder
 William III
 Louis XIV
 Wilhelmina
 War in Europe

(e) Belgium

Flanders
 Brabant
 Walloons
 Netherlands
 Ostend Company
 Frère-Orban
 Rogier
 Leopold I, II
 Albert I
 Vandervelde

Liège
 Namur
 Ostend
 War in Europe

(f) Switzerland

Helvetii
 Alemannia
 Burgundy
 Hapsburg
 Tell, William
 Morgarten
 Sempach
 Winkelried
 Morat
 Zurich
 Hofer, Andreas
 Sonderbund
 War in Europe

For the Historians:

Blok, P. J. (Dutch)
 Fryxell, A. (Swedish)
 Geijer, E. (Swedish)
 Juste, T. (Belgian)
 Merle D'Aubigné (Swiss)
 Motley, J. L. (Dutch)
 Munch, P. A. (Norwegian)
 Nielson, Y. (Norwegian)
 Steenstrup, J. C. H. R. (Danish)

10. SOUTH AMERICA AND MEXICO.

Beginning with Mexico in 1519, the great regions of Central and South America were rapidly brought under Spanish rule, Portugal, however, held sway in Brazil, and in Guiana small portions fell to other European nations. The harsh Spanish rule led to bitter but unsuccessful uprisings among the Indian tribes of Peru and Chile. The first quarter of the nineteenth century witnessed the successful revolt of the Spanish dependencies, aided in their struggle by the decidedly

friendly attitude of Great Britain and the United States, of whom the latter now assumes the rôle, largely, of protector over the newly established republics. A decided inaptitude for self-government is evinced by these, and chronic disorder checks national development. Chile, Argentina, and Mexico are, however, prominent exceptions. Brazil, after living tranquilly as an independent empire, enters upon the troubled career of republican politics towards the end of the nineteenth century. The influence of the United States in South America becomes an important factor with the completion of the work of building the Panama Canal. See:

Mexico
 Mexican Archæology
 Montezuma
 Cortés
 Mendoza, Antonio de
 Hidalgo, Miguel
 Morélos
 Itúrbide
 Guerrero, Vicente
 Santa Anna
 Mexican War
 Comonfort
 Juarez
 Miramon
 Almonte
 Maximilian
 Lerdo de Tejada
 Diaz, Porfirio
 Villa
 Huerta
 Madero
 Zapata
 Central America
 Guatemala
 Nicaragua
 Zelaya

Honduras
 Salvador
 Costa Rica
 Morazán
 Carrera, Rafael
 Walker, William
 Peru
 Huayna Capac
 Pizarro, Francisco
 Pizarro, Gonzalo
 Almagro
 San Martin, José de
 Prado, M. I.
 Bolivia
 Chile
 Araucania
 Valdivia, Pedro de
 Carrera, José Miguel de
 O'Higgins, Bernardo
 San Martin, José de
 Balmaceda, José Manuel
 Argentina
 Rosas, Juan Manuel
 Urquiza, Justo José
 Mitre, Bartolomé
 Sarmiento, Domingo F.
 Uruguay
 Gauchos
 Artigas, Fernando José
 Flores, Venancio
 Paraguay
 Guaraní
 Francia, José Gaspar
 Lopez, Francisco Solano
 Colombia
 Ecuador
 Venezuela
 Castro, C.
 Miranda, F.
 Bolivar, Simon
 Paez, José Antonio
 Brazil
 Pedro I, II
 Fonseca, Deodoro da

For the Historians and Investigators,
see:

Ixtlilxochitl
Prescott
Bancroft, H. H.
Bandelier, A. F. A.
Charnay, C. J. D.
Squier, E. G.
Markham, C. R.
Vicuña-Mackenna, Benjamin

11. THE FAR EAST.

(1) INDIA. The history of India may be divided into three periods, that of the early Hindu domination, the period of Mohammedan rule, and the period of European supremacy. See:

(a) For the Peoples:

India
Indian Peoples
Aryan
Dravidians
Tamils
Telugus
Kanarese
Malayalim

(b) For the History:

India
Bimbisara
Sandrocottus
Ghaznivides
Timur
Baber
Akbar
Shah Jehan
Aurangzebe
Nadir Shah
Ahmed Shah
Gama, Vasco da
Albuquerque
Almeida
Pondicherry
Goa

Dupleix
Clive
East India Company
Hastings, Warren
Cornwallis, Lord
Wellesley, Marquis of
Nana Sahib

For the Religions of India, see Chapter
on RELIGION.

(2) CHINA. China presents the spectacle of a nation which, having attained a high degree of civilization at a time when Europe was still barbarian, has been content to remain quiescent while the world has moved forward. In spite of its vast latent strength, it seems destined to become the prey of European ambitions, unless the example of its kindred nation, Japan, should lead it to recognize the civilization of the West, and to observe the preponderant rôle that should be its own in the Orient. See:

China
Fuh-hi
She Hwang-Ti
Han
Genghis Khan
Kublai Khan
Ta Ts'ing
K'ang-hi
Hung-siu-ts'uen
Gordon, Charles George
Li Hung Chang
Kwang-Sü
Far Eastern Question
Tze-hsi
• Yuan Shih-kai

For the Philosophy and Religions of
China, see Chapter on RELIGION.

(3) JAPAN. Among the nations of the East, Japan stands forth as an amazing exception to Eastern immobility.

ity. The political balance in the Pacific has been quite upset by the appearance of this new power, which, in less than four decades, has passed from feudalism and Oriental seclusion to a constitutional government and the skilful utilization of the sciences and wisdom of the West. Japan's triumph over China in 1894-95 first marked strength; its magnificent struggle against Russian aggression in China and its participation in the Great War raised the possibility of a quite unexpected development in the relations between Europeans and Mongolians.

See:

Japan
 Jimmu Tennō
 Taira
 Samurai
 Minamoto
 Fujiwara
 Yoritomo
 Ashikaga
 Daimio
 Nobunaga
 Hideyoshi
 Iyeyasū
 Tokugawa
 Iyemitsu
 Perry, M. C.
 Kéiki
 Mutsuhito
 Arisugawa
 II Kamon no Kami
 Itagaki, Taisūke
 Ito, Hirobumi
 Iwákura, Tomomi
 Okubo, Toshimichi
 Okuma, Shigenobu
 Soyeshima Tanéomi
 Yamagata Aritomo
 Kato
 Yoshihito
 War in Europe

See also:

Nichiren
 Arai Hakuseki (1657—)
 Motoori Norinaya (1730—)
 Hokusai (1760—)
 Fukuzawa, Yukichi
 Kido, Takayoshi

For the Authorities, see:

Abeel, D.
 Beal, S.
 Biot, E. C.
 Griffis, W. E.
 Hirth, F.
 Julien, S. A.
 Legge, J.
 Morrison, R.

12. THE UNITED STATES.

Norse explorations in North America, about the year 1000, led to no result, and Europe, before the time of Columbus, had no knowledge of a world beyond the Atlantic. The discovery, in 1492, was followed by a period of exploration, in which Spanish, French, English, and Dutch participated. Settlement follows, and poverty and religious persecution in Great Britain stretches a chain of English speaking colonies along the eastern coast of what is now the United States. Swedes and Dutch give way in time, and with Spain restricted to Florida, England enters into a struggle for possession of the interior with France, whose rule has meanwhile been extended over the basins of the St. Lawrence, the Mississippi, and the Great Lakes. England triumphs, and brings under her authority the disputed territory east of the Mississippi.

See:

(a) The Discoverers:

Ericson

Vinland
 Madog
 Columbus
 Vespuccius
 Cabot
 Cortereal
 Verrazano
 Ponce de Leon
 Ayllon
 Narváez, P. de
 Nuñez Cabeça
 De Soto
 Coronado
 Drake
 Frobisher
 Gilbert, Sir Humphrey
 Gosnold
 Smith, John
 Norumbega
 Cartier
 Champlain
 Hudson
 Nicollet
 Joliet
 Marquette
 La Salle
 Hennepin
 Tonty
 Lewis, Meriwether
 Clark, William
 Pike
 Long, S. H.
 Bonneville
 Catlin
 Whitney, J. D.
 Hayden
 Powell, J. W.

(b) The Settlers:

See under the names of the thirteen original colonies; also:

London Company
 Plymouth Company
 Jamestown

Yeardley
 Berkeley
 Bacon
 Bradford, William
 Standish
 Endecott
 Winthrop
 Minuit, Peter
 Kieft
 Stuyvesant
 Hooker, T.
 Davenport, J.
 Williams, Roger
 Hutchinson, Anne
 Baltimore, Barons of
 Claiborne
 Friends
 Penn
 Oglethorpe

(c) For the Struggle with the French:

King William's War
 Queen Anne's War
 King George's War
 French and Indian War
 Pepperrell, Sir William
 Louisburg
 Albany Convention
 Braddock
 Amherst
 Abercromby
 Loudoun
 Wolfe, James
 Montcalm
 Pontiac
 Paris, Treaties of

England's triumph over France is followed almost immediately by the irreparable loss of the thirteen colonies. The injustice of Parliamentary taxation stirs the colonists to resistance, and the memory of their triumph over the French lends them courage for the struggle. See:

(a) The Pre-revolutionary Period:

Navigation Laws
Assistance, Writ of
Otis, James
Stamp Act
Sons of Liberty
Boston Massacre
Boston Tea Party
Boston Port Bill
Quebec Act
Adams, Samuel
Hancock, John

Marion
Sumter
Pickens
Lee, Richard Henry
Jones, Paul
Wayne, Anthony
Clark, George Rogers
Lafayette
Rochambeau
Grasse, Count de
Steuben
Kalb, Baron de

(b) The Revolution: (1) The Battles:

Lexington
Concord
Bunker Hill
Long Island
Trenton
Princeton
Brandywine
Germantown
Oriskany
Bennington
Saratoga
Monmouth
Camden
Cowpens
Guilford Court House
Eutaw Springs
Yorktown

Kosciuszko
Pulaski
Howe, Lord
Clinton
Burgoyne
Cornwallis
Tarleton
Jefferson
Franklin, B.
Livingston, R. R.
Deane, Silas
Sherman, Roger
Morris, Robert
Declaration of Independence

(2) The Men:

Warren
Putnam
Washington
Montgomery
Arnold
Lee, Charles
Gates
Greene
Conway
Stark
Herkimer
Morgan

The thirteen colonies, having vindicated their independence in a protracted war, are impelled for the defence of their now won liberties, and the furtherance of their common welfare, to organize themselves into a federal republic with a written constitution, in nature essentially a compromise between the ideas of local liberty and efficiency of the central authority. The Liberator of the nation is also its first executive. His death is followed by a struggle between the two constitutional principles. The advocates of "strict construction" triumph, and, in the person of Thomas Jefferson, the Republican-Democratic Party assumes power to hold it uninterruptedly for forty years. The

boundaries of the Union are extended by the admission of new States, and the national territory is enormously increased by the acquisition of Louisiana and Florida. Party differences disappear, for a while, after a second war with Great Britain, but a new cause of dissension appears in the form of the slavery question, which replaces constitutional politics by sectional. See:

(a) The Formation of the Union:

Constitution of the United States
Shays's Rebellion
Hamilton
Madison
Jay
Pinckney, C. C.
Wilson, James
Randolph, Edmund
Paterson, William
Henry, Patrick
Northwest Territory

(b) The Era of Party Strife:

Federalists
Anti-federalists
Federalist, The
Gallatin, A.
Marshall, John
Burr
Genet
Jay Treaty
Whisky Rebellion
X. Y. Z. Correspondence
Alien and Sedition Laws
Virginia and Kentucky Resolutions
Louisiana Purchase
Lewis and Clark Expedition
Continental System
Orders in Council
Embargo
Chesapeake, The

Constitution, The
Erie, Battle of Lake
Thames, Battle of the
Chippewa
Lundy's Lane
New Orleans, Battle of
Tippecanoe
Hull, Isaac
Hull, William
Lawrence
Perry
Macdonough
Hartford Convention
Cushing, Caleb
Ghent, Treaty of
Missouri Compromise
Monroe, James
Monroe Doctrine

The Democratic Party in the course of time did not fail to adopt many of the principles of the old Federalists, among them notably the national encouragement of internal improvements and the creation of a Government bank. The tendency on the part of a faction to lay stress on these functions of the Government led to the dissolution of the Democratic Party. The Whigs now appear, historically the successors of the Federalists and the predecessors of the Republican Party. The hierarchic succession of presidents ends in 1828, and the Western Democracy triumphs in the person of Andrew Jackson. Sectional feeling, fostered by growing economic differences between North and South, is intensified by the rise in the North of an outspoken spirit of opposition to the institution of slavery. The two political parties for a time eagerly ignore the issue, and Southern statesmen, armed with the threat of a disruption of the Union, succeed in coercing the conservatives in the North.

Territorial expansion, however, forces the slavery question into the foreground; the Whig Party, unwilling directly to challenge the issue, is succeeded by the Republican Party, which will. The Democratic Party is broken in two. With the triumph of the anti-slavery party in 1860, the South secedes from the Union. See:

(a) The Formation of Parties and the

Rise of the Slavery Question:

Democratic Party
 Adams, John Quincy
 Crawford, William
 Jackson, Andrew
 Caucus
 Whig Party
 Clay, Henry
 Cumberland Road
 Tariff
 Nullification
 McDuffie
 Calhoun, John C.
 Hayne, Robert
 Webster
 Abolitionists
 Garrison, William Lloyd
 Phillips, Wendell
 Lovejoy, Elijah
 Lundy, Benjamin
 Van Buren
 Marcy, W. L.
 Harrison, William Henry
 Tyler
 Webster-Ashburton Treaty
 Northeast Boundary Dispute
 Polk
 Texas
 Houston, Samuel
 Oregon
 Northwest Boundary Dispute
 Mexican War
 Wilmot Proviso
 Scott, Winfield

Taylor, Zachary

Fillmore

Cass

Clayton-Bulwer Treaty

(b) The Final Struggle over Slavery:

Free Soil Party
 Compromise Measures of 1850
 Fugitive Slave Law
 Seward
 Sumner
 Davis, Jefferson
 Underground Railroad
 Pierce, Franklin
 Kansas-Nebraska Bill
 Popular Sovereignty
 Thayer, Eli
 Republican Party
 Douglas, Stephen A.
 Taney, Roger
 Dred Scott Case
 Buchanan, James
 Brown, John
 Lincoln, Abraham
 Breckinridge, J. C.
 Bell, John
 Constitutional Union Party

(c) The Civil War:

Civil War in America
 Confederate States of America
 Stephens, Alexander
 Benjamin, Judah P.
 Toombs, Robert

1. The Battles:

I. In the East:

Fort Sumter
 Big Bethel
 Bull Run
 Ball's Bluff
 Williamsburg
 Seven Pines
 Mechanicsville

Gaines's Mill
 Savage's Station
 Frazier's Farm
 Malvern Hill
 Bull Run (second)
 Antietam
 Fredericksburg
 Chancellorsville
 Gettysburg

II. In the West:

Wilson's Creek
 Paducah
 Belmont
 Fort Henry and Fort Donelson
 Pea Ridge
 Shiloh
 Corinth
 Iuka
 Island No. 10
 New Orleans
 Perryville
 Stone River
 Vicksburg
 Chickamauga
 Chattanooga
 Mobile Bay

III. The Final Campaigns:

Dalton
 Kenesaw Mountain
 Nashville
 Fort McAllister
 Bentonville
 Wilderness
 Spottsylvania Court House
 Cold Harbor
 Monocacy
 Winchester
 Cedar Creek
 Five Forks
 Petersburg
 Appomatox Court House

2. The Men:

Grant
 Sherman
 Sheridan
 McClellan
 Meade
 Thomas
 Burnside
 Halleck
 Hooker
 Rosecrans
 Buell
 Hancock
 Pope
 Lyon
 Foote
 Farragut
 Lee
 Jackson
 Johnston
 Johnston
 Longstreet
 Beauregard
 Bragg
 Hood
 Early

(d) Emancipation Declaration

Draft Riots

Four years of civil war established the principle that the United States, once perhaps a federation, is now a nation. Slavery is abolished and a partisan Congress, under the stress of circumstances, gives the ballot to the liberated bondsmen. Reconstructed, the Southern States devote themselves to the task of rebuilding their wasted fortunes on old ruins and new conditions. The South recognizes the lesson of the war in its bearing on the nature of our Government, but refuses to recognize the capacity for political and social equality in the negro, and in the last

years of the nineteenth century enters upon a deliberate policy of negro disfranchisement through State legislation. In the North and West, the era is one of extraordinary material growth, and political questions of the time are largely economic—currency, tariff, labor, and monopoly. With the acquisition of the Spanish possessions in the Pacific, and the assumption of the task of building the interoceanic Panama Canal, the United States begins its career as a world power. See:

(a) The Restored Union:

Johnson, Andrew
Reconstruction
Freedman's Bureau
Carpet Baggers
Ku-Klux Klan
Knights of the Golden Circle
Force Bill
Tenure of Office Act
Stanton
Alaska
Chase, S. P.
Stevens, T.

(b) From the Close of the Civil War Period:

Grant, U. S.
Alabama Claims
Grange
Credit Mobilier of America
Virginius Massacre
Whisky Ring
Electoral Commission
Custer
Modoc
Sioux
Indians
Centennial Exhibition

Hayes, R. B.
Tilden

Strikes and Lockouts

Bland, R. P.

Greenbacks

Greely, H.

Garfield, J. A.

Arthur, C. A.

Harrison, B.

Bering Sea Controversy

Tariff

Hawaiian Islands

Cleveland, G.

Venezuela

World's Columbian Exposition

McKinley, Wm.

Blaine, J. G.

Reed, T. B.

Spanish-American War

Cuba

Philippines

Porto Rico

Trusts

Pan-American Exhibition.

Roosevelt, T.

Hay-Pauncefote Treaty

Panama Canal

Root, E.

Louisiana Purchase Exposition

Russo-Japanese War

Hughes, C. E.

Trusts

Lodge, H. C.

Poindexter, Miles

Taft, Wm. H.

Pugo

Knox, P. C.

Conservation

Trusts

Tariff

Lorimer, Wm.

Aldrich, N. W.

- Mexico, *History*
 La Follette, R. M.
 Cummins, A. B.
 Penrose, B.
 Borah, Wm.
 Wilson, W.
 Bryan, Wm. J.
 Parker, A. B.
 Underwood, O.
 Brandeis, L. D.
 McAdoo, Wm. G.
 Daniels, J.
 Reserve Bank, Federal
 Mexico, *History*
 Tariff
 Mann, J. P.
 O'Gorman, J. A.
 Newlands, F. G.
 Kern, J. W.
 Owen, R. L.
 Gore, T. P.
 Smith, Hoke
 Stone, Wm.
 War in Europe
 Party Names
 Money
 Coinage
 Labor Organizations
 Arbitration
 Railways (Interstate Commerce
 Act)
 Trusts
 Tariff
 For the Historians:
 Adams, C. F.
 Adams, H.
 Bancroft, G.
 Bancroft, H. H.
 Beard, C. A.
 Brodhead, J. R.
 Bryce, James
 Burgess, J. W.
 Channing, F.
 Coffin, C. C.
 Curtis, G. T.
 Dodge, T.
 Doyle, J. A.
 Dunning, W. A.
 Fiske, J.
 Frothingham, R.
 Gayarré, C.
 HARRISSE, H.
 Hart, A. B.
 Higginson, T. W.
 Hildreth, R.
 Holst, H. E. von
 Johnston, A.
 Lodge, H. C.
 Lossing, B.
 McMaster, J. B.
 Palfrey, J. G.
 Parkman, F.
 Peter Martyr
 Rhodes, J. F.
 Robinson, J. H.
 Ropes, J. C.
 Schouler, J.
 Shea, J. G.
 Sloane, W. M.
 Sparks, J.
 Thorpe, F. N.
 Thwaites, R. G.
 Wilson, W.
 Winsor, J.

Chapter 2. Law and Political Science

NATIONAL or Municipal law is commonly divided into two general classifications, Substantive Law, and Adjective or Remedial Law. Substantive Law prescribes and defines the normal relations of social and political life, that is, legal rights, obligations, and privileges, as distinguished from violations of the normal, legal order. (See Substantive Law.) Adjective or Remedial Law deals with abnormal conditions, such as crimes, and with the methods of enforcement of legal rights. Both of these classifications are severally divided into Public Law and Private Law. The title, Public Law, is applied to those subjects which have to do with the relations of individuals to the various branches of government. Private Law includes the rules governing the relations of individuals to each other, and their rights in and over property. While, for some purposes, Substantive and Remedial Law are so closely connected that a complete knowledge of one is not possible without an acquaintance with the other, yet, in general, it may be said that, for practical purposes, the average layman is concerned chiefly with the rules of Substantive Law, except, perhaps, Public Remedial Law—the Law of Crimes. For example, it is quite necessary that a person in business be somewhat familiar with the ordinary principles of the Law of Contracts, but it is not necessary that he should know how to proceed in law to obtain redress for the breach of a contract.

International Law is distinguished from Municipal Law, in that the former deals with the relations of nations with each other, and such rules of law as will be recognized by nations in dealing with the citizens of each other, while the latter deals with the relations of one nation to its citizens, and the relations of the citizens with each other. International Law is administered, generally, in the various courts of each nation when applicable, but the refusal of a nation to recognize any of its principles could only be met by a declaration of war on the part of the aggrieved nation or nations, whereas the sovereign power of a nation sanctions and enforces Municipal or National Law. Therefore, to avoid confusion, topics in International Law are placed in a separate classification.

For a General Discussion of the Nature and Purposes of Law, see:

Law	Municipal Law
Jurisprudence	Mercantile Law
Substantive Law	Military Law
International Law	

A. Substantive Law

I. PUBLIC SUBSTANTIVE LAW.

This branch of substantive law is commonly divided into two general

classifications, CONSTITUTIONAL and ADMINISTRATIVE LAW. Constitutional law deals with the nature and powers of the Government, and correlatively with

the rights and privileges of citizens with reference to the Government. The name, ADMINISTRATIVE LAW, is applied to that portion which controls and regulates the enforcement of the will of the Government, as expressed by constitutions, statutes, etc.

1. CONSTITUTIONAL LAW :

Constitution
Constitutional Law
Constitution of the United States
Magna Charta
Amendment
Federal Government
Police Power
Veto
Eminent Domain
Bill of Rights
Civil Rights Bill
Bill of Attainder
Sovereignty
State
Ex post facto
Retroactive
Due Process of Law
Congress
Legislature
Legislation
Conflict of Laws
Act
Act of Parliament
Repeal
Citizen
Alien
Naturalization
Allegiance
Domicile
Alien and Sedition Acts
Expatriation
Expulsion
Liberty of Individual
Liberty, Religious
Emancipation

Reprieve
Territories
Consolidation Acts
Restraint of Trade
Interstate Commerce Act
Granger Cases
Concurrent Jurisdiction
Original Package
Income Tax
Inheritance Tax
Dartmouth College Case
Slaughter-House Cases
Dred Scott Case
Fugitive Slave Law
Homestead Laws
Poor Laws
Tenure of Office Act
Legal Tender Cases
Debt, Public
Convention
Election
Vote
Fishing Laws
Franchise

2. ADMINISTRATIVE LAW :

Administrative Law
Executive Department
State, Department of
Diplomacy
High Commission
Commission
Commissioner
Municipality
Municipal Government
Municipal Law
Municipal Ownership
Municipal Reform Acts
Civil Administration
Court
Supreme Court of U. S.
Courts, Military
Court Baron
Court of Session

County Court
 Common Bench
 Probate Court
 Petty Sessions
 District Court
 Sheriff's Court
 Ecclesiastical Court
 King's Bench
 Cassation, Court of
 Claims, Court of
 Instance, Court of
 Inns of Chancery
 Inns of Court
 Ordinance
 By-law
 Charter
 Building Acts
 Cemetery Laws
 Factor's Acts
 Intoxicating Liquors
 Grand Jury
 Justice, Lord
 Sheriff
 Justice of the Peace
 Marshal
 Coroner
 Assessors
 Auditor
 Alderman
 Attorney-General
 Surrogate
 Judge-Advocate
 Judge
 Referee
 Justice
 Justice, Department of
 Justice of the Peace
 Appointment

II. PRIVATE SUBSTANTIVE LAW

For convenience this portion of the substantive law is divided into two classifications, the Law of Persons and the Law of Property.

1. LAW OF PERSONS:

In law, both natural persons and those creations of the law, such as corporations, known as legal entities, or juristic persons, are classed together in the Law of Persons, as the same general principles apply to them. Under the title **NATURAL PERSONS**, are grouped titles dealing with the peculiar privileges and disabilities of married women, infants, and persons of unsound mind. Topics dealing with the family relation are for convenience grouped together.

(a) *Natural Persons:*

I. Persons Exercising Incomplete or Special Rights:

Infant
 Minor
 Legitimacy
 Apprentice
 Disability
 Married Women
 Feme Coverte
 Coverture
 Insanity
 Lucid Interval
 Capacity

(b) *Family Relations:*

Husband and Wife
 Settlement
 Marriage
 Divorce
 Alimony
 Adultery
 Separation
 Abandonment
 Paraphernalia
 Community of Property
 Emancipation
 Separate Estate

Parent and Child

Adoption

Bastard

Ancestor

Affinity

Consanguinity

Domicile

Guardian

(c) **Juristic Persons:**

Company

Corporation

Ultra Vires

De Facto

Charitable Trusts

Ecclesiastical Corporation

Joint Stock Company

Limited Companies

Limited Liability

Regulated Companies

Stock Company

Dividend

Director

Trust

Trust Fund Doctrine

2. LAW OF PROPERTY:

The term property includes everything that is the subject of possession and ownership, whether tangible or intangible. The various kinds of property are naturally divided into two classifications, **REAL** and **PERSONAL**. Real Property includes lands, tenements, and hereditaments, and interests therein. Subjects dealing with the disposition and incumbrance of real property *inter vivos* are also placed under this title. Personal Property includes all movable objects of property, commonly known as chattels, and such claims, obligations, and rights of action as are the subject of transfer. Topics treating of the transfer of property, both real and personal, by will or descent, are classed un-

der the title, **SUCCESSION AND INHERITANCE.**

(a) **Real Property:**

i. **Nature of Real Property:**

Real Property

Real Estate

Hereditament

Tenement

Mines and Mining

Feudalism

Fee

Fief

Feud

Feu

Accession

ii. **Systems of Tenure:**

Tenure

Seisin

Manor

Socage

Frankalmoigne

Gavelkind

Ground-Annual

Demesne

Ancient Demesne

Borough English

Burgage Tenure

Tenant Right

Community of Property

Mortmain

Subinfeudation

Sergeanty

Landlord and Tenant

Attornment

Lease

Leasehold

Common, Tenancy in

Tenancy at Sufferance

Tenancy at Will

Rent

Occupancy

Mining Claim

Life Estate
 Conditional Fee
 Remainder
 Reversion
 Freehold
 Dower
 Curtesy
 Entry, Right of
 Entirety
 Equity of Redemption
 Equitable Estate
 Riparian Rights
 Rivers, Navigable and Non-navigable
 Inclosures of Commons
 Use and Occupation
 License
 Pew Rights

iii. Transfer and Incumbrance of Real Property:

Alienation
 Incumbrance
 Bargain and Sale
 Conveyance
 Conveyancing
 Land Transfer, Reform in
 Abstract of Title
 Search of Title
 Deed
 Habendum
 Restrictive Covenants
 Conditional Limitation
 Quit Claim
 Lease and Release
 Demise
 Executory Devise
 Shifting Use
 Entail
 Shelley's Case, Rule in
 Enrollment
 Power of Appointment
 Power
 Ejectment

Eviction
 Adverse Possession
 Common Assurance
 Elegit, Estate by
 Jointure
 Escrow
 Settled Estate
 Tax Sale
 Tax Title
 Cloud on Title
 Perpetuity
 Prescription
 Quit Rent
 Office Found
 Partition
 Mortgage
 Merger
 Tacking of Mortgages
 Mechanic's Lien
 Servitude
 Easement
 Equitable Easement
 Incorporeal
 Equitable Mortgage
 Building Loans
 Donis Conditionalibus
 Domesday Book
 Recording Acts
 Recording of Deeds
 Torrens System
 Title, Registration of
 Title Insurance

(b) *Personal Property:*

i. Possession:

Chattel
 Movables
 Confusion
 Treasure-Trove
 Chose in Action
 Fixtures
 Emblements
 Estray
 Good-Will

- | | |
|---|---------------------------|
| Finding | Caveat Emptor |
| Oysters, Law as to | Delivery |
| Wreck | Condition and Conditional |
| | Vendor's Lien |
| ii. Patents, Patent Law : | Lien |
| Letters Patent | Bailment |
| Trademark | Carrier, Common |
| Trade-name | Baggage |
| Copyright | Bill of Lading |
| Literary Property | Forwarding |
| Invention | Consignment |
| Caveat | Stoppage in Transitu |
| | Joint Adventure |
| iii. Contracts, Obligations, and Intan- | Freight |
| gible Property Rights : | Negotiable Instruments |
| Contract | Negotiable Paper |
| Obligation | Promissory Note |
| Covenant | Check |
| Consideration | Bill of Exchange |
| Rescission | Bank-Bills |
| Discharge | Exchequer Bills |
| Breach | Bought and Sold Notes |
| Subrogation | Specialty |
| Abrogation | Bond |
| Suretyship | Stock |
| Pledge | Coupon |
| Reward | Credit, Letter of |
| Guaranty | Warehouse Receipt |
| Gift | Bottomry Bond |
| Claim | Indorsement |
| Debt | Dishonor |
| Creditor | Exchange |
| Commercial Law | Interest |
| Debtor | Agent |
| Payment | Factor |
| Chose in Action | Partnership |
| Accord and Satisfaction | Mercantile Agent |
| Assignment | Mercantile Agency |
| Donation | Master and Servant |
| Joint Ownership | Joint Liability |
| Sale | Insurance |
| Bill of Sale | Life Insurance |
| Auction | Accident Insurance |
| Market Overt | Wager Policy |

Account
Deposit
Voucher
Receipt
Seal
Notary Public
Acknowledgment
Debenture

(c) *Succession and Inheritance:*

Decedent
Estate
Inheritance
Intestacy
Distribution
Succession ab Intestato
Surveyorship
Primogeniture
Inventory
Administration
Will

Testament
Appraisement
Legacy
Residuary Legacy
Ademption
Advancement
Codicil
Share
Beneficiary
Per Stirpes
Devise
Personal Representative
Executor
Undue Influence
Deathbed, Law of
Heir
Heirloom
Accumulations
Lapse
Posthumous Child

B. Remedial Law

I. PUBLIC REMEDIAL LAW.

This portion of the Adjective, or Remedial, Law deals with crimes, the penalties therefor, and the method of prosecution of accused persons by the State. We shall first take up those topics which define particular crimes, under both statutes and the common law, and then those which deal with the prosecution and punishment of crimes. See:

Adjective Law

1. *Crimes, Misdemeanors, etc.:*

Crime
Criminology
Criminal Law
Misdemeanor
Accessory
Accomplice
Infamy

Felony
Barratry
Blackmail
Blasphemy
Body-Snatching
Bribery
By-Bidding
Burglary
Embezzlement
Robbery
Stolen Goods
Receiving Stolen Goods
Assault and Battery
Security
Security of Person
Manslaughter
Homicide
Murder
Malpractice
Consent

Infanticide
 Arson
 Smuggling
 Counterfeiting
 Subornation of Perjury
 Compounding of Felony
 Suicide
 Misprision
 Treason
 Overt Act
 Malicious Mischief
 Extortion
 Forgery
 Sunday
 Gambling
 Disturbance
 Eavesdropping
 Embracery
 Engrossing
 Forestalling
 Monopoly
 Harboring
 Champerty
 Concealment
 Corrupt Practices
 Simony
 Piracy
 Policy
 Fornication
 Rape
 Incest
 Rescue
 Riot
 Abortion
 False Pretenses
 Common Scold
 Sumptuary Laws
 Trading Stamps
 Habitual Drunkard

Arraignment
 Search
 Bench Warrant
 Search Warrant
 Writ
 Attainder
 Autrefois Acquit
 Benefit of Clergy
 Capital Punishment
 Charge and Specification
 Commitment
 Corporal Punishment
 Corruption of Blood
 Fine
 Forfeiture
 Hard Labor
 Information
 Indictment
 Justification
 Ordeal
 Outlawry
 Civil Death
 Peine Forte et Dure
 Penalty
 Posse Comitatus
 Nolle Prosequi
 Prisoner
 Prosecution
 Prosecutor
 Voir Dire
 Punishment
 Self Defense
 Sentence
 State's Evidence
 Corpus Delicti
 Ne Exeat
 Torture
 Extradition
 Locus Delicti

2. Criminal Procedure and Punishment of Crimes:

Criminal Procedure
 Arrest

II. PRIVATE REMEDIAL LAW.

This division of Remedial Law includes the law of Torts and Civil Practice and Procedure. Torts are

wrongs other than those arising out of contract, for which the injured party has a right of action. A tort action is not assignable and is not strictly a property right, and, therefore, the law of torts is properly considered remedial law. Under the title, Civil Practice and Procedure, are grouped all topics dealing with the enforcement of civil rights of action of a private nature.

1. TORTS, OR CIVIL WRONGS.

- Conversion
- Trespass
- Assault
- Trover
- Fraud
- Fraudulent Conveyance
- Infringement
- Slander of Title
- Defamation
- Slander
- Libel
- Contribution
- Intimidation
- Accident
- Injury
- Misrepresentation
- Nonfeasance
- Nuisance
- Negligence
- Malfeasance
- False Imprisonment
- Malicious Prosecution
- Mayhem
- Pollution of Watercourses
- Criminal Conversation
- Employer's Liability
- Fellow-Servants

2. CIVIL PRACTICE AND PROCEDURE.

In English jurisprudence, three distinct systems of procedure, corresponding and adapted to distinct systems of jurisprudence, were developed respect-

ively by the courts of common law, the courts of chancery, and the courts of admiralty. The common law procedure is much older than the procedure in either equity or admiralty, as practiced by the English courts, the *curia regis*,—which was the forerunner of the English Courts of Exchequer, Common Pleas, and King's Bench, in which the common law procedure was developed,—having been established in the early part of the twelfth century. Procedure in equity is much simpler than procedure at common law. Its essential characteristics are based on the fact that the sole power of that court is to command things to be done, and not directly to transfer or otherwise affect the rights of litigants. Procedure in admiralty was founded upon the Roman law and corresponds in many particulars to the equity system. The embarrassment experienced as a consequence of the technical character of the common law procedure has led to many reforms by legislation.

- Action
- Limitation of Actions
- Civil Action
- Civil Procedure
- Forms of Action
- Admiralty Law
- Equity
- Procedure
- Practice
- Pleading
- Process
- Code
- Code Napoléon
- Service of Papers and Process
- Next Friend
- Parties
- Name
- Plea

Common Counts	Month
Common Forms	Attachment
Common Plea	Foreign Attachment
Common Recovery	Letters Rogatory
Debt, Action of	Lis Pendens
Detinue	Oath
Assumpsit	Notary Public
Foreclosure	Precept
Replevin	Discovery, Bill of
Bill in Equity	Cognovit
Real Action	Cognizance
Civil Death	Color
Claim	Subpœna
Lawyer	Recoupment
Attorney	Ex Parte
Advocate	Distringas
Barrister	Garnishment
Counselor	Entry, Writ of
Solicitor	Quia Timet
Disbarment	Qui Tam Action
Client	Interrogatories
Plaintiff	Affidavit
Defendant	Bill of Particulars
Respondent	Certiorari
Joinder	Habeas Corpus
Writ	Motion
Declaration	Inquiry, Writ of
Confession and Avoidance	Inquisition
Answer	In Personam
General Issue	In Rem
Verification	Interpretation
Demurrer	Interpleader
Disclaimer	Injunction
Defense	Prohibition
Forma Pauperis, In	Special Proceeding
Cross-Bill	Specific Performance
Confession of Judgment	Trustee Process
Case	Warrant
Chambers	Quo Warranto
Chancery	Intervention
Cestui que Trust	Invoice
Cestui que Use	Bill of Peace
Master in Chancery	Acknowledgment
Citation	Civil Damage Acts

Forcible Entry and Detainer	Proof
District Attorney	Handwriting
Hilary Term	Testimony
Oyer and Terminer	Privilege
Venue	Privileged Communication
Judicature Acts	Laches
Jurisdiction	Dictum
Judge	Precedent
Jury	Res Adjudicata
Challenge	Presumption
Judge Advocate	Declaration or Affirmation
Oyer	Alteration
Stay	Access
Stare Decisis	Ambiguity
Damages	Argument
Day	Verdict
Marshalling	Special Verdict
Trial	Scotch Verdict
Mistrial	Judgment
Nonsuit	Award
Incident	Appeal
Judicial Notice	Bill of Costs
Evidence	Taxation of Costs
Exception	Bill of Exceptions
Circumstantial Evidence	Execution
Burden of Proof	Supersedeas
Condonation	Exemption
Admission	Sequestration
Examination	Distress
Cross Examination	Equitable Assets
Witness	Receiver
Expert	Winding Up of Company

C. International Law

The subjects or persons of International Law are independent sovereign States or nations. The community constituting such State is permanently established for a political end, is possessed of a defined territory, and is independent of external control. If one or more of these elements be lack-

ing, the community is not a State in the sense of International Law. Individuals choose their associates, and States likewise determine whether and when they wish to maintain relations with a newcomer. A fundamental proposition of International Law is the equality of States, of which Chief Justice Mar-

shall said: "No principle of general law is more universally acknowledged than the perfect equality of nations. Russia and Geneva have equal rights. It results from this equality that no one can rightfully impose a rule on another." See:

International Law
Treaty
Diplomacy
Diplomatic Agents
Envoy
Embassy
Ambassador
Neutrality
Enemy
Embargo
Blockade
Contraband
Mare Clausum
High Seas
Territorial Waters
Seashore

Tide Waters
Bering Sea Controversy
Extraterritoriality
Prescription
Privateering
Piracy
Award
Convoy
Extradition
Foreign Judgment
Foreign Law
War; War in Europe; War Zone
Truce
Acts of Hostility
Comity of Nations
Mainprize
Navigation, Freedom of
Navigation Laws
Recapture
Retaliation
Rules of the Road
Salvage
Seamen, Laws Relating to

D. History and Miscellany

1. AGRARIAN LAW:

Anglo-Saxon Law
Customary Law
Common Law
Civil Law
Civil Church Law
Twelve Tables
Salic Law
Scotch Law
Spanish Law
Oléron, Laws of
Law Merchant

2. PARLIAMENTARY LAW:

Revised Statutes
Medical Jurisprudence
Maxims

Legal Education

3. The following are a few of the names in the ranks of jurists, lawyers, and publicists of all time:

Austin, John
Betts, S. R.
Binney, Horace
Black, J. S.
Blackstone, William
Bluntschli, J. K.
Bodin, J.
Bracton, Henry de
Brougham, Lord
Campbell, John
Choate, Rufus
Coke, Edward

Cooley, T. M.
Curtis, G. T.
Ellsworth, Oliver
Erskine, Lord
Fearne, Chas.
Feuerbach, P. J. A.
Field, D. D.
Field, S. J.
Filangieri, G.
Fortescue, John
Gans, E.
Glanvill
Grotius, Hugo
Hale, Matthew
Holt, John
Janet, Paul
Jeffreys, Lord
Johnson, Reverdy
Kent, James
Laboulaye, E. L.
Lamar, L. Q. C.
Langdell, C. C.

Lieber, Francis
Livingston, Edward
Lowell, A. L.
Maine, Henry
Mansfield, Earl
Marshall, John
Montesquieu, C.
Moore, J. B.
Pardessus, J. M.
Parsons, Theophilus
Plowden, E.
Pollock, F.
Portalis, J. E. M.
Pufendorf, S.
Savigny, F. K.
Smith, Goldwin
Stephen, J. F.
Story, J.
Taney, R. B.
Tocqueville, A. C.
Wharton, F.
Woolsey, T. D.

Chapter 3. Sociology

Sociology

SOcial science presents a theoretical and a practical aspect, of which the latter, at the present time, is the more important. Speculation on the origins of social life, the evolution of social institutions, and the nature of existing social bonds has been rich in theories, diverse in view, but casting light on all the course of human development. Society has been variously regarded as an aggregate, an organization, or an organism, and accordingly as it has been regarded its rights and duties as against the individual have been outlined. The influence of the collective body and the collective mind on the body and mind of the individual forms one of the most fascinating topics of sociology, fascinating because of the close connection that may be established between individual and social progress. But as yet scarcely sufficient material has been collected to make social theory strictly scientific, and the greater interest, probably, attaches to what has been called the practical aspect of social science, the study, namely, of contemporary social conditions and the problems which they create. Thus it would not be far from the truth to call practical sociology, social pathology, for as a matter of fact the attention of the working sociologist is directed, in greater part, to the study of the ills of the social body, a study of those individuals and classes of individuals whose presence in the midst of society is a burden or a source of danger to society or the cause of misery to themselves. In this respect social science deals with the helpless and the vicious and is largely coincident with humanitarianism. Theoretical sociology is most closely allied to Anthropology and History, going to the latter for its evolutionary data and to the former for origins. Practical sociology depends very largely on statistics.

I. The methods and theories of sociology are treated at length under that heading, supplemented by minor articles on subsidiary topics. This article, therefore, should be made the starting point on reading. See:

Sociology
Man, Science of
Anthropo-geography
Acclimatization
Environment
Standard of Living
Crowd

A discussion of various social institutions which form part of the data

of the sociologist, such as the Family, Marriage, the Tribe, etc., will be found in the chapter on Anthropology and Ethnology.

II. 1. Taking human aggregates as its subject matter, practical sociology draws the greatest uses from statistics. The gathering of statistical data is being initiated wherever governments have as yet failed to assume the office, and where official enumerations prevail their scope is constantly being widened. The study of population is now well advanced. See:

Demography
Census
Population
Vital Statistics
Births, Registration of
Illiteracy
Transportation, Penal
Immigration
Emigration
Migration
Colony
Oriental Migration
Naturalization
Suicide
Infanticide
Divorce
Marriage
Statistics

2. "Dependents, Defectives, Delinquents," adequately describes the subjects dealt with by the social pathologists. In this immensely broad field, private efforts coöperate with State activity, the former through investigations and advocacy largely, the latter through remedial legislation and the use of State resources. For a study of the dependent and defective classes, see:

Dependents, Defectives, Delinquents
Social Debtor Classes
Debt
Pauperism
Poor Laws
Poor Rate
Casual Poor
Mendicancy
Eugenics
Tramp
Vagrant
Unemployment
Workhouse
Almshouse

Charitable Trusts
Rockefeller Foundation
Rockefeller, J. D.
Rockefeller, J. D., Jr.
Carnegie, A.
Charities
Charities and Correction, National
Conference of
Charity Organization Society
Brinkerhoff, Roeliff
Elberfeld System
Blind, Education of the
Keller, H. A.
Perkins, T. H.
Bridgman, L.
Howe, S. G.
Deaf Mute (*Institutions*)
Gallaudet, E. M.
Insane Asylum
Insanity
Idiocy
Mental Defectives
Mental Pathology
Medical Jurisprudence
Bedlam
Degeneracy
Jukes, The

3. Of dependent classes, children, naturally, absorb a large share of the attention of the sociologist and the charity worker. The mission here is not one of relief only, but of redemption, and successful effort in this field discounts future dangers to society. See:

Dependent Children
Foundling Hospital
Penology
Crèche
Marbeau, J. B.
Infant School
Ragged Schools
Rauhes Haus

George Junior Republic
 Parks and Playgrounds
 Juvenile Court
 Juvenile Offenders
 Lindsey, B. B.
 Children, Societies for
 Cruelty to Children, Prevention of
 Children's Aid Society
 Schools
 Wirt, Wm. A.

4. Sufficient reason exists for speaking of a criminal class to make Criminology an independent branch of investigation with something of the methodology of a science. The delinquent, the criminal, is regarded as at war with society. The causes that have changed the course of nature in him and made him anti-social may be heredity or environment or both. The prevention and punishment of crime and the possible reformation of the criminal form the subject matter of the "science." See:

Criminology
 Lombroso, Cesare
 Bertillon System
 Finger Prints
 Punishment
 Corporal Punishment
 Flogging
 Penology
 Capital Punishment
 Prisons
 Osborne, T. M.
 Convict
 Convict Labor
 Clinton State Prison
 Newgate
 Fleet Prison
 Millbank Prison
 Bicêtre
 Conciergerie

Transportation, Penal
 Botany Bay
 Bagnes
 Recidivists
 Reformatories
 Elmira Reformatory
 Juvenile Offenders
 Brockway, Z. R.
 Ticket of Leave
 Mettray
 Beccaria, C. B.
 Howard, John
 Round, W. M.
 Fliedner, T.
 Fry, Elizabeth
 Prison Association, American
 Prison Buildings
 International Prison Congress

5. The vices of individuals, as well as of classes, affect the welfare of the body politic. (a) The standard of personal purity is rising with the general heightening in moral tone. (b) The evils resulting from the abuse of liquor have led to one of the most notable movements of the nineteenth century. See:

- (a) Family
 - Marriage
 - Divorce
 - Infanticide
 - Syphilis
 - Concubinage
 - Eugenics
 - Celibacy
 - Illegitimacy
 - Bastard
 - Prostitution
 - White Slavery
- (b) Intoxicating Liquors
 - Intoxication
 - Temperance
 - Prohibition

Prohibition Party (Under Temperance)
 License
 Liquor Traffic
 Excise
 Local Option
 Gothenburg System
 Abstinence Societies
 Mathew, T.
 Dow, N.
 Gough, J. B.
 Keeley, L.
 Chaffin, E. W.
 Lend-a-Hand Clubs
 Loyal Temperance League
 Woman's Christian Temperance Union
 World's Woman's Christian Temperance Union
 Temperance, Sons of
 Good Templars, Independent Order of

6. The problem of remedying social evil has drawn the attention of men in all ages, and thinkers have been fond of busying themselves with the construction of ideal forms of society since the days of Plato. More than philosophers' dreams, however, are the great social movements of modern times, whose aim is the reorganization of society on a different basis than that of the present—private property.

(a) For the literary utopias, see:

Plato (The Republic)
 Campanella (The City of the Sun)
 Defoe, Daniel (An Essay on Projects)
 More, Thomas (Utopia)
 Harrington, James (Oceana)
 Bellamy, Edward (Looking Backward)

Bacon, Francis (New Atlantis)
 Fénelon, François (Voyage dans l'île des Plaisirs)

(b) For Communism, see:

Communism
 Communistic Societies
 Socialism
 Shakers
 Owen, Robert
 Blanc, J. J. L.
 Harmonists
 New Harmony
 Cabet, Etienne
 Icarians
 Saint-Simon, C. N.
 Fourier, F. M. C.
 Anarchism
 Wells, H. G.
 Brook Farm
 Hopedale
 Oneida Community
 Zoar Community
 Koreshan Ecclesia
 Amana
 Noyes, J. H.
 Perfectionists
 Taborites
 Moravians
 Anabaptists
 Separatists
 Ephrota

(c) For Socialism, see:

Socialism
 Collectivism
 Fourierism
 Nationalism
 Communism
 Value
 Capital
 Industrial Revolution
 Debs, E. V.
 Berger, V. L.
 National Workshops

Saint-Simon, C. H.
 Fourier, F. M. C.
 Rodbertus, J.
 Enfantin, B. P.
 Bazard, A.
 Considérant, V. P.
 Babeuf, F. N.
 Proudhon, P. J.
 Blanc, J. J. L.
 Marx, Karl
 Lassalle, F.
 Engels, F.
 Internationale
 Weitling, W.
 Liebknecht, K.
 Liebknecht, W.
 Gronlund, L.
 Bellamy, E.
 Bebel, F. A.
 Vollmar, G. H.
 Bernstein, E.
 Malon, B.
 Godin, J. B. A.
 James, E. J.
 Millerand, A.
 Jaures, J. L.
 Briand, A.
 Gronlund, Lawrence
 Morris, Wm.
 Hyndman, H. M.
 Fabian Society
 Webb, S.
 Kelly, E.
 Loria, A.
 Wagner, A.
 Schmoller, G.
 Shaw, G. B.
 Nieuwenhuis, D.
 Sabotage

(d) For Anarchism, see:

Anarchist
 Bakunin, M.
 Godwin, William
 Proudhon, P. J.

Tucker, B. R.
 Hess, Moses
 Syndicalism
 Industrial Workers of the World
 Ferrer
 Most, Johann
 Nihilism
 Michel, Louise

(e) For quasi-socialistic movements,
 see:

- (a) Municipal Ownership
 Single Tax
 George, Henry
- (b) Coöperation
 Rochdale Pioneers
 Consumers' League
 Profit Sharing
 Leclaire, E. J.

7. Socialism is heterodox in exalting the State over the individual, yet there is rapidly growing recognition of the right of the State to intervene for the protection of the working classes, and to assume functions tending to further their welfare. See:

Factory Inspection
 Labor Legislation
 Employers' Liability
 Employment Bureau
 Social Insurance
 Labor Church
 Labor Colonies
 Labor Congresses
 Labor Day
 Labor Organizations
 Labor Party
 Labor Problems
 Labor Exchange
 Child Labor
 Sweating System
 Lodging Houses
 Housing Problem

Tenement House Problem
Bath Houses, Municipal
Postal Savings Banks
Old Age Pensions
Vacant Lot Farming

8. A recent development of social work is the settlement house established in the congested district of great cities to act as a centre of physical and moral uplifting. See:

Social Settlements
People's Palace
Toynbee, Arnold
Hull House
Addams, Jane
Boys' Clubs
Fresh-Air Work
George Junior Republic

See also: Salvation Army; Booth, Charles; Pullman; Krupp Foundries, Social Work at; Y. M. C. A.; Y. W. C. A.

9. For a problem specifically American, see:

Negro in America
Negro Education
Hampton Normal and Agricultural Institute
Tuskegee Normal and Industrial Institute
Washington, Booker T.

Societies in the narrow sense, associations, that is, of individuals, for the attainment of a common aim, have always existed, illustrating in the miniature the gregarious nature of man. Their purpose may be various, social, political, religious, educational, or protective. See for types of each:

Societies
Club
Benefit Societies

Friendly Society
Building and Loan Associations
Secret Associations
Burschenschaft
Carbonari
Mafia
Camorra
Fenian Society
Patriotic Societies
Orders
Templars, Knights
Hospitalers
Brotherhoods, Religious
Jesuits
Societies for Ethical Culture
Fraternities, American College Academy
Institute of France
Royal Society
Historical Associations, American
Masons, Free
Odd Fellows, Independent Order of Pythias, Knights of
Elks, Benevolent and Protective Order of
Hibernians, Ancient Order of
Industrial Workers of the World

10. A partial list only of writers and investigators in sociology would include:

Addams, Jane
Althusius, Johannes
Ammon, Otto
Angell, George Thorndike
Appert, B. N. M.
Barth, Paul
Barton, Clara
Baxter, Robert D.
Bebel, F. A.
Birkbeck, George
Bodin, Jean
Booth, Charles
Buckle, Henry T.

Burdett-Coutts, A. G.
Burdett-Coutts, W. L. A.B.
Buxton, Sir Thomas F.
Considérant, V. P.
Cooper, Peter
Coram, Thomas
Crandall, Prudence
Darling, Grace
Durkheim, E.
Enfantin, B. P.
Fairbanks, Arthur
Faithfull, Emily
Folks, Homer
Fourier, François C. M.
Fry, Elizabeth
Galton, Sir Francis
Giddings, F. H.
Girard, Stephen
Godin, Jean B. A.
Gompers, Samuel
Gumplowicz, Ludwig
Gurney, J. J.
Guy, Thomas
Hanway, Jonas
Henderson, C. R.
Hill, Octavia
Hill, Sir Rowland
Hobhouse, L. T.
Holyoake, G. J.
Howard, John
Kidd, Benjamin
Kyrle, John

Lassalle, Ferdinand
Le Bon, G.
Le Play, P. G. F.
Liebknecht, K.
Liebknecht, W.
Livermore, M. A.
Lloyd, Henry D.
Mathew, Theobald
Montefiore, Sir Moses H.
Montyon, A. J. B.
Moon, William
Mott, Lucretia
Neale, Edward V.
Pinkerton, Allen
Rowton, M. W. L.
Sadler, M. T.
Schäffle, A.
Schulze-Delitzsch, H.
Seligman, E. R. A.
Sharp, Granville
Smith, Gerrit
Stuckenberg, J.
Tarde, G.
Torrens, W. T. McC.
Toynbee, Arnold
Ward, Lester F.
Waugh, Benjamin
Webb, Sidney
Willard, Frances E.
Wines, F. H.
Worms, René

Chapter 4. Political Economy

Political Economy

Political Economy has been briefly defined as the science of wealth, but this definition requires a further explanation of the peculiar sense in which the term wealth is employed. Wealth has been defined as the body of things that have value, but here again value in the economic sense has a narrower meaning than in ordinary use. Value, in economic discussion, usually means power in exchange, that is, the power of a commodity to command other commodities in exchange. Such attempts at brief definition, however, are not satisfactory, since each primary concept of the science is itself the text for long discussion. The best introduction to the subject will be found in the article, **POLITICAL ECONOMY**, which outlines clearly the content or scope, the relation of political economy to other branches of study, and the methods of investigation or arrangement that it employs.

I. The fundamental principles should then be studied by reference to the following articles:

Wealth
Production
Labor
Division of Labor
Industrialism
Wages
Money
Bank, Banking
Standard of Living
Capital
Interest
Usury
Rent

Tax
Single Tax
Métayer
Profit
Monopoly
Speculation
Consumption
Value
Coöperation
Distribution
Exchange
Tariff

The history of economic thought should be studied next. In ancient and mediæval times political economy was not marked off from other branches of learning, and no attempt was made to study it systematically. From the historical paragraphs in the article, **POLITICAL ECONOMY**, it will be seen that to the Greek and Roman philosophers, as well as to the mediæval churchmen, the laws of trade were of interest mainly in their moral bearings. Even in the eighteenth century, when some of its principles were understood, and something like a systematic study was attempted, its scope and importance were not realized. It was regarded as a branch of statecraft. Not private wealth, but the best means of increasing financial power of the state was the main object of investigation. For an account of the various systems of economic thought, and the contributions of individual economists, see the following:

Mercantilism
Physiocrats
Laissez-Faire

Manchester School
 Free Trade
 New Freedom
 Open Door
 International Trade
 Protection
 Balance of Trade
 Navigation Laws
 Tariff
 Quesnay, F.
 Smith, Adam
 Ricardo, D.
 Malthus, T. R.
 Thünen, J. H. von
 Say, J. B.
 Carey, H. C.
 Bastiat, F.
 Mill, J. S.
 Cairnes, J.
 Jevons, W. S.
 Walker, F. A.
 Marshall, Alfred
 Boehm von Bawerk, E.
 Clark, J. B.
 Wagner, Adolf
 Schmoller, G.
 Menger, K.
 Nicholson, J. S.
 Patten, S. N.

Obviously the study of past economic conditions is essential to an understanding of the present. On the general subject of Industrial Evolution consult the following:

Manufactures
 House Industry
 Mir
 Guild
 Hanseatic League
 Merchants Adventurers
 Mercantilism
 Physiocrats
 Industrial Revolution

Factories and the Factory System
 Cartwright, E.
 Open Field System
 Agriculture
 Hargreaves, J.
 Arkwright, Sir R.
 Crompton, Samuel
 Watt, James
 Whitney, Eli
 Spinning
 Weaving
 Wool
 Cotton
 Loom
 Textile Manufacturing
 Eight-Hour Day

(See UNITED STATES, GREAT BRITAIN, GERMANY, etc., for economic evolution of those countries.)

II. Reading the above topics in the order given will have supplied the theoretical and historical basis for the study of actual conditions, practical questions, and proposed measures of reform, which are arranged logically in the following lists:

1. TRADE AND TRANSPORTATION:

Commerce
 Barter
 Chamber of Commerce
 Imports and Exports
 Demand and Supply
 Exchange
 Foreign Money
 Ad Valorem
 Coasting Trade
 Competition
 International Trade
 Balance of Trade
 Stock Exchange
 Bond
 Stock

Bucket Shop
 Customs Duties
 Lloyds
 Underwriter
 Crisis, Economic
 Speculation
 Transportation
 Railways
 Express Company
 Baggage
 Commerce Court
 Treaty
 Commercial Treaties
 Reciprocity
 Tariff
 Geography, Economic
 Mercantile Agency
 Port of Entry
 Pooling
 Labor and Commerce, Department
 of
 Municipal Ownership

See also statistics of Commerce and
 Railways under the various countries,
 as UNITED STATES, GREAT BRITAIN,
 CHILE, etc.

2. LABOR AND CAPITAL:

Trade Unions
 Labor
 Capital
 Labor and Capital, Relations of
 Socialism
 Communism
 Anarchism
 Political Economy
 Division of Labor
 Labor Organizations
 Knights of Labor
 Labor, American Federation of
 Industrial Workers of the World
 Wages
 Minimum Wage
 Labor Union, The American

Railway Brotherhoods
 Typographical Union of North
 America
 Letter Carriers, National Associa-
 tion of
 Metal Trades Association
 Miners, Western Federation of
 Mine Workers of America
 Labor Representation Committee
 Labor Party, British
 Manufactures
 Strikes and Lockouts
 Industrial Arbitration and Concilia-
 tion
 Sabotage
 Syndicalism
 Eight-Hour Day
 Standard of Living
 Union Label
 Interlocking Directorates
 Boycotting
 Lockout
 Picketing
 Labor Problems
 Labor Colonies
 Labor Congresses
 Contract Labor Law
 Labor Day
 Labor Legislation
 Labor, Department of
 Labor Church
 Industrial Revolution
 Sweating System
 Employment Bureau
 Labor Exchanges
 Labor, Bureaus of
 Child Labor
 Employers' Liability
 Workingmen's Compensation
 Accidents, Industrial
 Factory Inspection
 Social Democracy
 Shops
 Injunction

3. GOVERNMENTAL REGULATION AND ENCOURAGEMENT OF COMMERCE AND INDUSTRY:

Protection
 Customs Duties
 Tariff
 Drawback
 Warehousing System
 Mercantilism
 Industrial Commission
 Latin Union
 Hamilton, Alexander
 List, Friedrich
 Balance of Trade
 Corn Laws
 Anti-Corn-Law League
 Cobden Club
 Reciprocity
 Shipping Subsidies
 Coasting Trade
 Monopoly
 Trusts
 Trust Fund Doctrine

4. MONEY AND CREDIT:

Money
 Precious Metals
 Foreign Money
 Bullion
 Coinage
 Numismatics
 Index Numbers
 Tabular Standard
 Bimetallism
 Latin Union
 Monetary Conferences
 Monetary Commission
 Gresham, Sir Thomas
 Gresham's Law
 Greenbacks
 Currency
 Greenback Party
 Specie Payments, Suspension and Resumption of

Fiat Money
 Credit
 Credit, Letter of
 Crisis, Economic
 Interest
 Bank, Banking
 Land Banks
 Clearing-House
 Trust Companies
 Bill of Exchange
 Exchequer Bills
 Crédit Foncier
 Mortgage Banks
 Rural Credit
 Reserve Bank, Federal

5. TAXATION AND FINANCE:

Finance
 Tax, Taxation
 Debt, Public
 Independent Treasury
 Repudiation
 Tariff
 Customs Duties
 Excise
 Internal Revenue System
 Budget
 Income Tax
 Land Tax
 Special Assessment
 Single Tax

See also sections on *Finance* under the various countries, as UNITED STATES, GREAT BRITAIN, BRAZIL, etc.

6. INSURANCE AND SAVINGS INSTITUTIONS:

Insurance
 Life Insurance
 Fraternal Insurance
 Fire Insurance
 Marine Insurance
 Friendly Societies
 Workingmen's Insurance

Tontine
Underwriter
Annuity
Savings Banks
Post Office Savings Bank
Trust Companies
Building and Loan Associations

7. AMONG PROMINENT ECONOMISTS,
in addition to those already named in
the lists, are the following:

Achenwall, Gottfried
Adams, H. C.
Aguado, A. M.
Anderson, James
Ashley, W. J.
Astor, John Jacob
Atkinson, Edward
Bagehot, Walter
Baring
Baring, A.
Bastable, C. F.
Bastiat, F.
Bates, Joshua
Baudrillart, H. J. L.
Baxter, Robert D.
Beckmann, Johann
Bemis, Edward W.
Biddle, Nicholas
Blanqui, J. A.
Block, Maurice
Bodin, Jean
Boehm von Bawerk, E.
Boisguilbert, P. le P.
Brentano, L. J.
Cairnes, John E.
Carey, Henry C.
Carli, G. R.
Cernuschi, Henri
Chevalier, M.
Child, Sir Josiah
Clark, John B.
Cobden, Richard
Cohn, Gustav

Cooke, Jay
Cossa, Luigi
Courcelle-Seneuil, J. G.
Cournot, A. A.
Decker, Sir Matthew
Dewey, Davis R.
Drexel, Anthony J.
Ely, Richard T.
Engel, Ernst
Farr, William
Farrer, T. H.
Faucher, J.
Fawcett, Henry
Ferraris, C. F.
Field, Cyrus F.
Fisher, I.
Fisk, James
Fix, Théodore
Frick, H. C.
Gage, L. J.
Galiani, F.
Garnier, J. C.
Genovesi, A.
Giffen, Sir Robert
Gioja, M.
Giovannitti, A. M.
Girard, Stephen
Glass, Carter
Gould (family)
Gournay, J. C. M. V.
Hadley, A. T.
Hamilton, Robert
Harriman, Edward H.
Haxthausen, A.
Hermann, F. B. W.
Hewitt, A. S.
Hill, James J.
Hobson, J. A.
Horner, F.
Horton, S. D.
Howe, S. G.
Hudson, G.
Hufeland, G.
Ingram, J. K.

Jenks, J. W.
 Jevons, W. S.
 Kay, Joseph
 King, Wm. L. M.
 Knox, J. J.
 Laing, S.
 Laughlin, J. L.
 Laveleye, Emile
 Law, John
 Le Play, P. G. F.
 Leroy-Beaulieu
 Leslie, T. E. C.
 Levasseur, E.
 Levi, Leone
 List, F.
 Loria, A.
 McCulloch, J. R.
 Mackay, C. W.
 Macleod, H. D.
 Malthus, T. R.
 Marshall, A.
 Mayo-Smith, R.
 Menger, Karl
 Morgan, J. P.
 Mun, Thomas
 Necker, Jacques
 Newmarch, William
 Nicholson, J. S.
 North, Sir Dudley
 Oncken, August
 Overstone, S. J. L.
 Parien, M. L. P. F. E.
 Paterson, Wm.
 Peabody, G.
 Pender, Sir John

Petty, Sir William
 Price, Richard
 Quesnay, F.
 Raiffeisen, F. W.
 Rau, K. H.
 Rogers, J. E. T.
 Roscher, W. G. F.
 Rothschild
 Say, J. B.
 Say, L.
 Schäffle, A. E. F.
 Schmoller, G.
 Schulze-Delitzsch, F. H.
 Seeböhm, F.
 Seligman, E. R. A.
 Senior, N. W.
 Soetbeer, A.
 Sumner, W. G.
 Taussig, F. W.
 Tooke, Thomas
 Torrens, Robert
 Tucker, Josiah
 Vanderbilt (family)
 Wagner, Adolf
 Wagner, H.
 Walker, F. A.
 Walker, R. J.
 Walrus, M. E. L.
 Watkin, Sir E. W.
 Wells, D. A.
 Wolowski, L. F. M. R.

8. FOR ECONOMIC AND SOCIAL RE-
 FORM MOVEMENTS, see section 6 of
 the preceding division (Sociology).

Chapter 5. Anthropology

TAKEN in its broadest signification, Anthropology, the science of Man, would include within its scope all the sciences and arts as dealing with particular phases only of the history of human life on earth. Physiology, Psychology, Philosophy, Linguistics and Literature would then be proper fields of study for the anthropologist, as to a large extent they are. But the field of human knowledge is so broad, and the scope of every particular science in fact so extensive, that in the nature of things no single mind can at the present day carry on the work of scientific investigation in more than a limited field of inquiry. Practically, therefore, anthropology, with its allied science of ethnology, has become the study of a man as a zoölogical genus, and secondly, the study of the origins of culture as deduced from ancient remains and the testimony afforded by surviving savage races whose life has as yet undergone no such differentiation as to put it beyond the study of a single mind. Among them are sought the germs of present institutions and beliefs, which are followed up until they become the things of which history takes cognizance. Primitive life, then, is largely the subject of anthropology which deals also with survivals of primitive modes of life and methods of thought in our own times. Thus the topic of Folklore and Customs falls fairly within its field. See:

Man, Science of
Anthropology
Ethnography

1. The study of human anatomy and physiology is of primary importance in the science of man. On the basis of morphological and physiological peculiarities, various classifications of mankind have been made, and our knowledge of prehistoric man is largely a matter of skulls and thigh bones. The measurement of the human body has become a science in itself. See:

Somatology
Cranimetry
Skin
Mongolian Spots
Anthropometry
Melanism and Albinism
Hair
Giants

Dwarf
Skull

2. Remains of prehistoric man have been found in both hemispheres, but most plentifully in Europe. Ingenious comparative studies allow us to arrive at a fair conception of the physical characteristics of the earliest inhabitants of the world. See:

Barrow
Mound-Builders
Megalithic Monuments
Dolmen
Avebury
Stonehenge
Spy
Chelléan
Cro-Magnon
Furfooz Race
Hallstatt Epoch
Madeleine, La

Mousterian Epoch
Neanderthal Man
Lansing Man
Kitchen-Midden

3. For the great divisions of mankind determined on the basis of physical characteristics and geographical distribution, see:

Caucasian Race
Europe, Peoples of
Mediterranean Race
Mongolian Race
Negro
Indian Peoples
Malayan Peoples
Melanesians
Indians, American.
Mixed Races

4. On the question of the origin of mankind there has been much disputation among anthropologists with little positive results. See:

Evolution
Pithecanthropus

5. Man has nowhere been found in complete isolation. From the first he appears as the social being with his life conditioned by the co-existence of others of his kind. Co-existence meant likeness of thought and experience and the necessity of intercommunication. Our interest, therefore, turns to language. See:

Language
Philology
Gesture Language
Sign Language
Writing
Hieroglyphics
Cuneiform Inscriptions
Wampum

6. In common with the animals

man is early engaged in a struggle for the material needs of existence, with greater needs to satisfy, however, than the animals, and consequently with growing resources.

(a) The desire for food is the primal motive in life. See:

Cannibalism
Geophagy
Cookery
Pottery

(b) According to the nature of the physical conditions amidst which he dwelt, man found shelter for himself. See:

Tent
Wigwam
Cave-Dwellers
Cliff-Dweller
Mesa
Earth Lodge
Lake Dwellings
Archæology, American
Casa Grande
Oaxaca, Ruins of
Palenque
Nomad
Gypsies

(c) Dress, it is well established, came from no need of protecting the body, but had its origin in ornament. See:

Dress
Tattooing
Headdress
Hairdressing

7. Man entered upon a rapid course of development when, in his search for sustenance and shelter, he began the use of tools. See:

(a) For Implements:
Flint Implements

Celt
Stone Age
Bronze, Age of
Archæology, American
Paleolithic Period

(b) For Weapons:

Arrow
Blowgun
Tomahawk
Boomerang
Scalping

For the beginnings of the agricultural stage, see:

Agriculture
Plow
Domestic Animals

8. The religion of primitive man is essentially the belief in a universally animated world, a world of spirits, to combat and placate whom is the business of his life. See:

Animism
Totemism
Superstition
Religion, Comparative
Magic
Necromancy
Oracle
Nature-Worship
Fire-Worship
Phallicism
Fetishism
Shamanism
Amulet
Manitou
Demonology
Demoniac
Satanism
Voodoo
Ghosts
Fast
Sacrifice

9. Birth and death are naturally portentous phenomena to the primitive mind, and are marked, death especially, by various ceremonies. In case of death the rites connect themselves with the belief in existence beyond the grave. See:

Couvade
Circumcision
Teknonymy
Infanticide
Mortuary Customs
Burial
Cist-burial
Suttee
Coffin

10. The origin of the family relation is a subject of much controversy; and the older view that, preceding the present organization of the family under the authority of the father and conditioned by the element of property, mankind passed through a stage in which the family centered around the mother, in whom authority was vested, and from whom descent was traced has been abandoned. See:

Marriage
Matriarchate
Partriarchate
Polygamy
Polyandry
Levirate Marriage
Clan
Tribe
Totemism
Caste
Exogamy
Miscegenation
Slavery

11. Primitive morality is often regarded as utilitarian and narrow in the scope of its application; but a

great deal of data has accumulated to negate this interpretation. In primitive life the social group is independent politically and, hence, frequently hostile with its neighbors, but this is not essentially different from civilized governments. Internally each of these primitive groups is governed by a legal code. Primitive law is summed up in custom. See:

Law
Custom
Taboo

12. Energy not directed towards the direct satisfaction of material wants finds expression among savages in games and sports. *Æsthetics*, modern research goes to show, had its origin in play. See:

Art, Primitive
Æsthetics
Swastika
Festivals
Dancing
Corroboree
Sun Dance
Snake Dance
Music
Areois
Potlatch

13. The survival of primitive thought in custom, legend, superstition, and common practices shows how continuous is the line of development from the mental life of primitive man to our own. For the entire subject of folk lore, see:

Folklore
Nursery Lore
Nursery Rhymes
Superstition
Magic

Witchcraft
Incantation
Vampire
Werwolf
Griffin
Dragon
Unicorn
Mermaid
Fairy
Morgan, the Fay
Avalon
Goblins
Oberon
Puck
Robin Goodfellow
Baring-Gould, S.

14. The data of anthropology have been collected from many sources, and the outline of the principles of the science may be filled in with concrete detail, by referring to the many descriptive articles on the primitive peoples. Of the most interesting primitive groups for the anthropologists, a partial list would be the following:

(a) For America, see **INDIANS**, **AMERICAN**, an elaborate study which may be carried into great detail by following out the cross references to every tribe of North, Central, and South America. See also **ESKIMO**.

(b) For Asia:

Philippine Islands
Aino
Andamanese (under Andamans)
Sundanese (under Sunda Islands)
Dyak
Gonds
Gurkhas
Khonds

Karens
 Mois
 Miao-Tse
 Shans
 Thai
 Todas
 Veddas
 Baluchis (under Baluchistan)
 Bhil
 Bedouin
 Kurds
 Buriats
 Giliaks
 Kalmucks
 Golds
 Kirghiz
 Koriaks
 Ossetes
 Tchuktchi
 Tchuvashes
 Tatars
 Ugrians
 Uzbeks
 Vedahs
 Yakuts
 Yukagirs
 Malayan Peoples
 Polynesians
 Melanesians
 Micronesians
 Negritos

(c) For Africa:

Akka
 Bantu
 Bejas
 Berber
 Kabyles
 Bushmen
 Hottentots
 Kafirs
 Dinka
 Fellah
 Masai

Hausa (under Hausa States)
 Niam Niam
 Somali
 YOLOF
 Yoruba
 Zulus (under Zululand)

(d) For Australasia:

Australians (under Australia)
 Maoris
 Tasmanians (under Tasmania)

(e) For Europe:

Europe, Peoples of
 Basque Race
 Gypsies
 Lapps (under Lapland)

15. A partial list of well-known anthropologists would include the following names:

Andre, R.
 Bandelier, A. F. A.
 Bastian, A.
 Beauchamp, W. M.
 Berendt, K. H.
 Boas, F.
 Brinton, D. G.
 Broca, P.
 Catlin, G.
 Cushing, F. H.
 Faidherbe, L. L. C.
 Flower, W. H.
 Fritsch, G. T.
 Furness, W. H.
 Gatschet, A. S.
 Haddon, A. C.
 Hale, H.
 Hartmann, R.
 Hodge, F. W.
 Holmes, W. H.
 Kanitz, F. P.
 Kroeber, A. L.
 Laufer, B.

Lubbock, J.
McCurdy, J. F.
McGee, W. J.
McLennan, J. F.
Mallery, G.
Mantegazza, P.
Mason, O. T.
Mooney, J.
Morgan, Jacques de
Morgan, L. H.
Mortillet, L. L.
Pilling, J. C.
Powell, J. W.
Prichard, J. C.

Putnam, F. W.
Quartrefages, J. L. A.
Ranke, J.
Ratzel, F.
Reinach, S.
Ripley, W. Z.
Rivers, W. H. R.
Schoolcraft, H. R.
Sergi, G.
Smith, Buckingham
Squier, E. G.
Topinard, P.
Tylor, E. B.
Ujfalvy, C. E.

Chapter 6. Religion

OF THE numerous classifications of religion, none of which is free from many serious objections, we may adopt as the most practical that which divides creeds into monotheistic and non-monotheistic; and though here, too, we are confronted by the difficulty that certain faiths are neither one nor the other, completely, we may apply the former term to the three great religions of Judaism, Christianity, and Mohammedanism, and classify under the second heading all beliefs whatsoever, from primitive animism through the various national mythologies to the great moral and philosophic systems of the East. The starting point should be the comprehensive article on RELIGION, COMPARATIVE. The subject may be then pursued through such general articles as BELIEF, WORSHIP, RITE, PRAYER, SACRIFICE, PRIEST, etc. Additional titles, in great number, will naturally suggest themselves to the reader. The field, indeed, is extensive and touches intimately on the domains of Anthropology, Psychology, Philosophy, and History. This will be found especially true in the religions of the East, where philosophy and mythology or religion are practically one.

A. Polytheistic Religions

1. The beginnings of religion, as studied in the beliefs of primitive races, will be found treated in the chapter on Anthropology, where appear such titles as

Man, Science of
Nature-Worship
Fetishism, etc.

The subject is carried on in the special articles dealing with individual tribes and nations, of which a list appears in the same chapter.

2. The religions and mythologies of the Babylonia, Assyria, Egypt, Greece, and Rome are discussed in the chapter on History, in the various sections devoted to those countries. The intimate connection of the religions and the political life in the ancient world has made this division seem desirable.

3. The mythology of the Scandinavian and Teutonic races differs from

that of Greece in its pervading atmosphere of gloom and the foreboding of fate. The northern divinities lack the joyous grace and humanity of the Olympian pantheon, and the powers of darkness, cold, and death play a far more conspicuous part. See:

Mythology
Polytheism
Scandinavian and Teutonic Mythology
Edda
Aesir
Asgard
Bifröst
Yggdrasil
Mimir
Norns
Odin
Tyr
Thor
Bragi

Balder
Loki
Freyja and Frigga
Ragnarök
Fenrir
Walhalla
Hel
Niflheim

4. We leave pure polytheism in passing to the great religions of India. It, there, evolves with time into complex systems of mythology modified by pantheism and agnosticism.

(a) BRAHMANISM.

Brahmanism may go back to the second millennium before the Christian era, and comprises the mass of beliefs and institutions originated or elaborated from a primitive nature-worship, by the Brahmans, who constitute the dominant class among the Hindus. It is essentially a legislative system, with a vast and minutely outlined ceremonial. In its later development, it is characterized by pantheism, the doctrine of Karma, and metempsychosis. See:

Brahmanism
Aryan
Veda
Brahmana
Upanishad
Manu
Brahma
Varuna
Agni
Indra
Ushas
Maruts
Pitris
Sankhya
Nyaya
Vedānta

Mahabharata
Rāmāyana
Vishnu
Śiva
Krishna
Purāna
Tantra
Vaishnavas
Śaivas
Śāktas
Pārvati
Kali
Lakshmi
Hanumān
Ganesa
Śraddha
Caste
Henotheism
Karma
Metempsychosis
Theosophy
Sikhs

(b) BUDDHISM.

Buddhism antedates Christianity in its origin, and its adherents are second in number only to those of the Christian faith. Taking its rise in Hindustan, it has spread over China, Indo-China, Japan, Tibet, and the plains of Northern and Central Asia. In that continent, its mission as a bearer of civilization and morality has been not unlike the rôle played by Christianity in Europe and America. See:

Buddhism
Pitaka
Asoka
Metempsychosis
Karma
Nirvana
Śravaka
Shin-Shu
Bonze

For a Variant of Buddhism, see

Lamaism

And, for an Allied Creed, see

Jainism

See also Brahmanism, above.

5. ZOROASTRIANISM.

In the great religion of Iran, we may find the earliest traces of primitive Aryan belief. Zoroastrianism is important for the influence it exercised on Judaism and Christianity, to which it contributed the great dualistic principle of the conflict between good and evil. See:

Zoroastrianism

Zoroaster

Avesta

Gâthâs

Pahlavi Language and Literature

Magi

Parsis

Ghebers

Ormazd

Ahriman

Mithras

Asmodeus

Saoshyant

6. The prevailing religion in China and Japan is Buddhism. The native religious systems of China are in reality moral philosophies. In Japan, however, we find a peculiarly national religion, influenced to some extent by Chinese and Buddhistic elements. See:

(a) Confucius

Mencius

Chu-Hi

(b) Taoism

Lao-tse

(c) Shintō

Kōbō Daishi

Fox-deity

Bushido

B. Monotheistic Religions

I. JUDAISM.

The history of the Jewish people, who claimed to be the nation specially favored of the One God, and the sole depository of His revelation, will be largely found in the historical chapter of this book; but here a few further indications may be given of some of their peculiar institutions. Their worship, in its earlier form, is described under TABERNACLE, then under TEMPLE, and in a special section of the article SACRIFICE, and a still later development is treated under SYNAGOGUE.

Special observances at particular seasons are treated under:

Passover

Purim

Atonement, Day of

Pentecost

Dedication Feast

Weeks, Feast of

Tabernacles, Feast of

Sabbath

Jubilee, Year of

On their sacred writings, besides the articles on each book of the Old Testament, see:

Talmud

Targum

Midrash

Gemara

Mishna

The functionaries of their religion and justice come under:

Priest
High Priest
Levite
Scribe
Rabbi
Sanhedrin

Other characteristic customs and usages:

Circumcision
Tithes
Unction
Proselyte
Urim and Thummim
Phylactery

The sects and parties which developed in course of time among the race are detailed under JEWISH SECTS, and specially in the following articles:

Pharisees
Sadducees
Essenes
Chasidim
Frank, Jacob

II. CHRISTIANITY.

1. FOUNDATIONS. The history of Christianity is so diversified, and so intimately bound up with the development of European civilization, that a large amount of space is necessarily accorded to it. The most convenient division will begin with the foundations, including under that head the articles centring around its Founder and the history and worthies of the first few centuries of the Christian era, before Europe was submerged in the chaos which resulted from the barbarian invasions. See:

Christianity
Creeds and Confessions
Fundamentals of Christian Doctrine
Development of Doctrine

God
Jesus Christ
Incarnation
Hypostatic Union
Atonement
Intercession, Doctrine of
Resurrection
Miracles
Holy Ghost
Filioque
Trinity, Doctrine of the
Nicene Creed
Prayer
Providence
Predestination
Foreknowledge and Foreordination
Sin
Original Sin

Besides the article under the title ESCHATOLOGY, several others which follow deal with the problems which have so exercised the mind of man as to his ultimate destination after the short period of life in this world. See:

Immortality
Judgment, Final
Millennium
Second Advent of Christ
Apocalyptic Literature
Antichrist
Annihilationism
Heaven
Beatific Vision
Hell
Probation after Death
Purgatory
Limbus

The following articles deal with the organizations by whose means the religion of Christ was spread throughout the world, and with early records of its faith and practice:

Church

Council
 Synod
 Missions, Christian
 Apostle
 Doctors of the Church
 Fathers of the Church
 Persecutions of the Christians
 Lapsed
 Catechumens
 Disciplina Arcani
 Agapæ
 Teaching of the Twelve Apostles
 Apostolic Constitutions
 Apostolic Fathers
 Jerusalem, Councils of
 Nicæa, Councils of
 Constantinople, Councils of
 Ephesus, Councils of
 Council of Chalcedon (under Chalcedon)

For the great figures of the period of foundation and dissemination, see:

Mary
 Joseph
 John the Baptist
 Peter
 Paul
 John
 James
 Philip
 Bartholomew
 Thomas
 Andrew
 Jude
 Barnabas
 Matthias
 Mark
 Luke
 Mary Magdalene
 Timothy
 Titus
 Stephen
 Justin Martyr
 Ignatius

Irenæus
 Polycarp
 Agnes
 Agatha
 Alban
 Apollos
 Athanasius
 Arius
 Augustine
 Barbara
 Basil
 Boniface
 Cassianus, Johannes
 Cecilia
 Chrysostom
 Cyprianus
 Cyril of Alexandria
 Cyril of Jerusalem
 Denis
 Dionysius
 Ephraem
 Epiphanius
 Eusebius
 Felicitas
 Fortunatus, Venantius
 Gregory of Nazianzus
 Gregory of Nyssa
 Gregory Thaumaturgus
 Gregory of Tours
 Hilary
 Hippolytus
 Hosius
 Isidore of Seville
 Jerome
 Lawrence
 Martin of Tours
 Patrick
 Prudentius, Aurelius Clemens
 Theodore of Mopsuestia

2. EARLY SECTS AND HERESIES.

No sooner had the Christian Church been fully organized and entered upon its mission of converting, than the infinite diversity of human minds im-

pelled different men to emphasize disproportionately some one aspect of the faith which all at first held in common. This was especially the case during the first three centuries, while Christianity had its chief stronghold in the East, the speculative and dialectical minds of whose people were naturally inclined to minute questions of abstract theology. The heresies which took their rise in the West were of a more practical kind, dealing, like Montanism, with the severity of discipline, or, like Pelagianism, with the freedom of the human will. Those who wish to trace the abstruse questions which threatened to divide the Church even before it had emerged from the shadow of persecution, may consult especially the following articles:

Adiaphorists
 Adoption Controversy
 Arius
 Aëtius
 Agnoetæ
 Alogians
 Apollinaris
 Celsus
 Cerdonians
 Cerinthus
 Docetæ
 Donatists
 Dositheans
 Ebionites
 Elkesaites
 Eutyches
 Gnosticism
 Hesychasts
 Iconoclasm
 Macedonians
 Manichæism
 Monarchians
 Monophysites
 Monothelitism

Montanus
 Nestorians
 Nicolaitans
 Novatian
 Origen
 Patripassianism
 Paulicians
 Pelagianism
 Sabellius
 Semi-pelagianism
 Valentinians
 Vigilus

3. TRADITIONAL CHRISTIANITY.

The latter history of Christianity may be most conveniently divided into two main heads—according as the various Christian bodies have adhered, to a greater or less extent, to the older usages or beliefs, or have broken away from them, and evolved new ones of their own. Of these two divisions, the former is inevitably much the larger, covering a much greater extent of time and a wider range of subjects. The naturally unchanging East has been less affected by the currents of thought, and the many practical problems, which have introduced many changes or developments in the western world. The articles **PAPACY**, which traces the history of the central see of Christendom, down to the Council of Trent; **ROMAN CATHOLIC CHURCH**, which includes the subsequent history of the churches in communion with it; and **GALLICAN CHURCH**, give a large part of the general institutional development; and the biographies of nearly all the Popes, contain valuable indications of the policy which has at different periods guided the larger part of Christendom. The article, **CHURCH HISTORY**, contains an account of the principal

writers who have narrated this development; and the following articles contain detailed information on all the more important points.

(a) For Church Organization, see:

Patriarch
Metropolitan
Archbishop
Bishop
Titular Bishops
Suffragan
Apostolic Succession
Orders, Holy
Cardinal
Conclave
Legate
Priest
Rector
Vicar
Vicar-General
Archdeacon
Cathedral
Dean
Chapter
Rural Dean
Deacon
Subdeacon
Acolytes
Reader
Exorcist
Ostiarius
Tonsure
Council
Encyclical Letters
Bull
In Coena Domini
Unigenitus
Brief, Papal
Church Discipline
Excommunication
Dispensation
Indulgence
Inquisition

Congregation
Propaganda
Index
Commandments of the Church
Celibacy

(b) Christianity had scarcely been organized before a definite form of worship was adopted, and this became more and more fixed and uniform in its details as time went on. A great many matters of interest are contained in the history of these liturgical forms, which will be found fully given under numerous titles. See:

Worship
Liturgy
Mozarabic Liturgy
Mass
Requiem
Introit
Kyrie Eleison
Gloria in Excelsis
Collect
Epistle
Gradual
Sequence
Gospel
Offertory
Secret
Missal
Pontifical
Ritual
Processional
Canonical Hours
Breviary
Lesson
Te Deum
Magnificat
Nunc Dimittis
Miserere
De Profundis
Ave Maria
Angelus Domini

Hymnology
 Dies Iræ
 Pange Lingua
 Tantum Ergo
 Veni Creator Spiritus
 Litany
 Benediction
 Rosary of the Blessed Virgin Mary
 Tenebræ

(c) Under **COSTUME, ECCLESIASTICAL**, a full account will be found of the historical development of ecclesiastical vestments and their use at the present day in various parts of Christendom. A number of other articles also give details as to specific vestments and articles used in divine worship. See:

Tiara
 Pallium
 Mitre
 Crosier
 Stole
 Maniple
 Surplice
 Flabellum
 Altar
 Tabernacle
 Incense
 Censer
 Cross
 Chalice
 Corporal
 Agnus Dei

(d) The Christian religion, at least in its ancient and traditional form, is essentially a sacramental one. In other words, it provides for the twofold nature of man—body and soul—by using outward and visible signs to convey inward and spiritual grace. A large number of important subjects, accordingly, fall under the heading **Sacrament**. See:

Sacrament
 Baptism
 Clinic Baptism
 Heretic Baptism
 Sponsors
 Confirmation
 Lord's Supper
 Transubstantiation
 Viaticum
 Penance
 Confession
 Absolution
 Orders, Holy
 Marriage
 Extreme Unction
 Sacramentals
 Holy Water
 Scapular
 Jubilee
 Pilgrim
 Stations
 Image-Worship
 Foot-Washing

(e) Very early in the history of the Christian Church, special observances began to be connected with certain days—weekly, and annual commemorations of events in the life of its Founder, and anniversaries of the chief worthies who adorned its history. These are treated under:

Sunday
 Friday
 Festivals
 Fast
 Christmas
 Epiphany
 Candlemas
 Annunciation
 Ash-Wednesday
 Lent
 Holy Week
 Maundy Thursday

Good Friday
 Easter
 Ascension Day
 Pentecost
 Trinity Sunday
 Corpus Christi
 Assumption of the Virgin Mary
 All-Soul's Day
 Ember-Days
 Angel
 Michael
 Gabriel
 Saint
 Martyr
 Canonization
 Beatification
 Advocatus Diaboli
 Acta Sanctorum

(f) It is scarcely necessary to enumerate the separate books of the Bible, on which every organization of Christians professes to base its creed. Under each of their titles, the history and purport of every book may be studied, as well as the most approved conclusions of the most recent scientific criticism. Questions relating to the Bible as a whole are discussed at great length in the main article **BIBLE**; and reference may be made to the following subsidiary titles:

Inspiration
 Revelation
 Canon
 Biblical Criticism
 Bible Archæology
 Textual Criticism
 Tübingen School
 Concordance
 Apocrypha
 Deuterocanonical Books
 Bible Society
 Bible, Curious Editions of

4. **THE MONASTIC LIFE.** As the civilized world, under the later Roman empire, grew more and more corrupt, the feeling gained ground that the surest way to escape from the wrath to come was to flee into the desert, and by prayer and mortification to avert the divine displeasure. The monastic life, therefore, considered as the most perfect carrying out of the counsels of Christ, took firm root in the Church. General details of its spirit and organization will be found under:

Monasticism
 Asceticism
 Vow
 Monastery
 Laura
 Hermit
 Recluse
 Pillar Saint
 Abbey
 Abbot
 Canon
 Brothers, Lay
 Brotherhoods, Religious
 Tertiary
 Monastic Art

The earlier monastic ideal was that of absolute separation from the world, considered as an inherently wicked place; and all the older orders, though frequently of the greatest service to society and civilization by their preservation of learning, and by their diligent labors in agriculture and the like, approach more or less the type known as cloistered orders. Of these the principal ones follow in chronological sequence, with their founders, where these have separate articles:

Antony

Paul
 Basilian Monks
 Augustinians
 Benedictines
 Benedict
 Cluniacs
 Camaldolites
 Carthusians
 Bruno
 Chartreuse, La Grande
 Charterhouse
 Cistercians
 Bernard
 Premonstratensians
 Gilbertines
 Beguines
 Carmelites
 Servites
 Celestines
 Brigittines
 Bridget
 Ursulines
 Angela Merici
 Trappists
 Rancé, Armand de

As modern society gradually became organized on more stable foundations, and men whose temperaments and habits were peaceful could be safe under its protection, another type came forward, whose fundamental idea was not retirement from the world, but an effort to sanctify it, by mingling more or less with it. Under the head of what may be called missionary communities, the following are to be noted:

Sisterhoods
 Trinitarians
 Franciscans
 Francis of Assisi
 Clares, Poor
 Clare
 Dominicans

Dominic
 Minimites
 Francis of Paola
 Barnabites
 Theatines
 Capuchins
 Jesuits
 Ignatius of Loyola
 Oratory, Congregation of the
 Philip Neri
 Oblates
 Borromeo, Carlo
 Piarists
 Visitation, Sisters of the
 Francis de Sales
 Chantal, Jeanne Françoise
 Lazarists
 Vincent de Paul
 Sulpicians
 Olier, Jean Jacques
 Brothers and Sisters of Charity
 Brothers of the Christian Schools
 La Salle, Jean Baptiste de
 Passionists
 Paul of the Cross
 Redemptorists
 Liguori, Alfonse Maria di
 Sacred Heart, Ladies of the
 Mercy, Fathers of
 Paulists

5. MEDIEVAL PERIOD. The religious aspect of the Middle Ages will be found represented in nearly every article in the foregoing section; but certain others may be added which give an account of significant developments taking place within this period. Thus we have the formal organization of a whole logical system of dogmatic theology and philosophy (see SCHOLASTICISM), and of a parallel system of ethics or moral theology (see CASUISTRY). The story of the CRUSADES is of great importance, supplemented

under JERUSALEM by the history of the kingdom and patriarchate there established. The crucial controversies between Church and State which persisted throughout the Middle Ages are treated under INVESTITURE and REGALIA as well as under PAPACY. (See also in the chapter on history the section dealing with the Mediæval Ages.) Under SCHISM, WESTERN, we may follow the division within the Church caused by the pretensions of rival popes. The efforts made to secure unity of faith and discipline appear under:

Lateran Councils
Basel, Council of
Ferrara-Florence, Council of
Pisa, Council of
Lyons, Councils of
Inquisition
Torquemada

The story of those who in this period broke away from that unity is told under:

Cathari
Fratricellians
Albigenses
Waldenses
Brothers and Sisters of the Free Spirit
Apostolic Brethren
Lollard
Abélard
Berengarius of Tours
Gottschalk
Wiclif

Other topics of special mediæval interest are:

Joan, Pope
Feast of Fools
Biblia Pauperum
Pseudo-Isidorian Decretals

Fulda, Monastery of
Saint Gall
Monte Cassino

The great names in the theology, philosophy, and mysticism of the Mediæval Ages include:

Adalbert
Ailly, Pierre d'
Albert, Count of Bollstädt
Alexander of Hales
Anselm
Aquinas, Thomas
Becket, Thomas à
Bede
Bonaventura
Catharine of Siena (under Catharine)
Clémanges, Nicolas de
Columba
Damiani, Pietro
Duns Scotus
Dunstan
Eadmer
Erigena, Johannes Scotus
Joachim of Floris
Kempis, Thomas à
Lanfranc
Lully, Raymond
Malachy
Occam, William of
Peter Lombard
Peter the Hermit
Rabanus Maurus
Savonarola, Girolamo
Tauler, Johann
Teresa, St.
Wadding, Luke
William of Saint-Amour
William of Wykeham

6. THE REFORMATION PERIOD. A special section may well be devoted to the period of unrest and disruption commonly known as the Reformation.

All over Europe there was a movement, more or less general and permanent according to local circumstances, towards throwing off the authority of the Pope, simplifying faith and worship, and returning to what were assumed to be primitive beliefs and usages. See:

Reformation
Counter-Reformation
Utraquists
Communion in Both Kinds
Brethren, Bohemian
Augsburg Confession
Interim
Concord, Book of
Corpus Doctrinæ
Magdeburg Centuries
Epistolæ Obscurorum Virorum
Antinomianism
Bartholomew's, Massacre of Saint
Dort, Synod of
Reformed Churches
Trent, Council of

For the Men of this Period, see:

Albert (of Magdeburg)
Baronius, Cæsar
Bellarmine
Beza, Théodore
Bucer, Martin
Bugenhagen, Johann
Cajetan, Thomas
Campion, Edmund
Calvin, John
Canisius, Petrus
Cano, Melchior
Carlstadt
Colet, John
Eck, Johann Maier von
Erasmus, Desiderius
Erastus, Thomas
Faber, Jacques
Fisher, John
Hamilton, Patrick

Hooper, John
Hutten, Ulrich von
Luther, Martin
Melancthon, Philip
More, Thomas
Æcolampadius, Johannes
Philip the Magnanimous
Reuchlin, Johann
Sarpi, Paolo
Tetzel, Johann
Vermigli, Pietro Martire
Wishart, George
Zwingli, Ulrich

7. Before proceeding to a review of the Reformed Churches of modern times, the history of Eastern Christianity, separate from that of the Roman Catholic Church since 1054, may be studied under the following titles:

Greek Church
Filioque
Quinisext
Photius
Lucaris
Nikon
Raskolniki
Dukhobortsy
Molokani
Skoptsy
Stundists

8. MODERN REFORMED CHURCHES.

(a) **ANGLICAN.** The article under the title, **ANGLICAN COMMUNION**, explains the extent and relations of the various churches in communion with the Church of England, which represent characteristically the more conservative elements in the religion of the English-speaking races. Though as organizations they owe their origin to the great upheaval of the sixteenth century, their doctrine and usages are

largely in harmony with those which prevailed before the Reformation, and will be found treated in many instances under titles which include the ancient and modern Roman Catholic belief or practice. The following articles, however, may be consulted for specifically Anglican points:

England, Church of
Ireland, Church of
Episcopal Church
Articles, The Thirty-nine
Prayer-Book
Homily
Lambeth Conference
Church Congress
Supremacy, Royal
Ecclesiastical Commissioners
Vestry
Warden, Church
Parish
Parish Clerk
Lay Reader
Advertisements of Elizabeth
Martin Marprelate Controversy
Savoy Conference
Nonjurors
Nonconformists
Dissenters
Act of Uniformity
Oxford Movement
Gorham Controversy
Ecclesiastical Titles Assumption
Act
Ritualism
Queen Anne's Bounty
Christian Knowledge, Society
for Promoting
Church Temperance Society
Brotherhood of Saint Andrew
Daughters of the King
Bampton Lectures
Hulsean Lectures

Among the prominent names in the history of the Church of England in Great Britain appear:

Cranmer, Thomas
Ridley, Nicholas
Latimer, Hugh
Hooker, Richard
Laud, William
Andrewes, Lancelot
Hall, Joseph
Ken, Thomas
Leighton, Robert
Taylor, Jeremy
Sanderson, R.
Whitgift, J.
Tillotson, John
Wake, William
Atterbury, Francis
Warburton, William
Simeon, Charles
Romaine, W.
Pusey, Edward Bouverie
Keble, John
Rose, Hugh James
Forbes, Alexander P.
Liddon, Henry Parry
Maurice, Frederick Denison
Arnold, Thomas
Robertson, Frederick W.
Milman, Henry Hart
Jowett, Benjamin
Stanley, Arthur Penrhyn
Wilberforce, Samuel
Trench, Richard Chenevix
Vaughan, Charles J.
Wordsworth, Charles
Wordsworth, Christopher
Benson, Edward White
Lightfoot, Joseph Barber
Westcott, Brooke Foss
Thorold, Anthony Wilson
Stubbs, William
Bright, William

Tait, Archibald Campbell
Temple, Frederick

Of the Church in America the leading representatives have been :

Seabury, Samuel
White, William
Hobart, John Henry
Provoost, Samuel
Hopkins, John Henry
Muhlenberg, William Augustus
Tyng, Stephen H.
Whittingham, William Rollinson
Williams, John
Whipple, Henry B.
Potter, Horatio
Potter, Alonzo
Potter, Henry Codman
Brooks, Phillips
Newton, Richard Heber
Dix, Morgan

(b) PRESBYTERIAN :

Presbyterianism
Elder
Moderator
Synod
Westminster Assembly
Perth, Five Articles of
Cameronians
Covenants, The
Infralapsarian
Alexander, Archibald
Alexander, J. A.
Babcock, M. D.
Baird, C. W.
Briggs, C. A.
Burrell, D. J.
Calamy, Edmund
Cameron, J.
Chalmers, Thomas
Cuyler, T. L.
Geddes, J.
Green, W. H.

Hall, John
Hodge, C.
Knox, John
Melville, Andrew
Parkhurst, C. H.
Patton, F. L.
Paxton, J. R.
Prentiss, G. L.
Prime, S. I.
Robinson, C. S.
Shields, C. W.
Talmage, T. DeWitt
Tennent, Gilbert
Watson, John
Witherspoon, J.

(c) METHODIST :

Methodism
Itinerancy
Experience Meeting
Camp-Meeting
Epworth League
Wesley, John
Wesley, Charles
Whitefield, George
Coke, Thomas
Huntingdon, Selima Hastings
Asbury, Francis
Clarke, Adam
Emory, John
Fowler, C. H.
Haven, E. O.
Haven, Gilbert
Hurlbut, J. L.
Hurst, John F.
Moore, D. H.
Moore, Henry
Newman, J. P.
Ouseley, G.
Punshon, W. M.
Sankey, Ira D.
Strong, James
Taylor, W.
Tefft, B. F.

Townley, James
 Townsend, L. T.
 Vincent, J. H.
 Walden, J. M.
 Warren, H. W.
 Watson, R.
 Wise, Daniel

(d) CONGREGATIONALIST:

Congregationalism
 Puritans
 Separatists
 Browne, Robert
 Robinson, John
 Cotton, John
 Mather, Richard
 Hooker, Thomas
 Edwards, Jonathan
 Hopkins, Samuel
 Bellamy, Joseph
 Dwight, Timothy
 Abbott, Lyman
 Bartlett, S. C.
 Beecher, Henry Ward
 Beecher, Lyman
 Bissel, E. C.
 Bushnell, H.
 Dexter, H. M.
 Finney, C. G.
 Gladden, W.
 Park, E. A.
 Parker, Joseph
 Phelps, Austin
 Storrs, R. S.
 Taylor, N. W.

(e) BAPTIST:

Baptists
 Baptism
 Baptism, Infant
 Anabaptists
 Münzer, T.
 John of Leyden
 Mennonites
 River Brethren

Burrage, H. S.
 Conant, T. J.
 Hall, R.
 Lorimer, G. C.
 Peters, M. C.
 Ripley, H. J.
 Robinson, E. G.
 Spurgeon, C. H.
 Vedder, H. C.
 Wayland, F.

(f) LUTHERAN:

Lutheranism
 Reformation, The Protestant
 Luther
 Melancthon
 Augsburg Confession
 Greenwald, Emanuel
 Muhlenberg, H. M.
 Muhlenberg, J. P. G.
 Seiss, J. A.
 Stuckenberg, J. H. W.

(g) DUTCH REFORMED:

Reformed Church in America
 Belgic Confession
 Heidelberg Catechism (under
 Catechism)
 Dort, Synod of
 Classis
 Ferris, I.
 Riddle, M. B.

(h) QUAKER OR FRIENDS:

Friends
 Fox, George
 Penn, William
 Hicks, Elias
 Gurney, J. J.
 Wilbur, John

(i) UNITARIAN:

Unitarianism
 Arius
 Socinus
 Servetus, Michael

Biddle, John
 Priestley, Joseph
 Allen, J. H.
 Chadwick, J. W.
 Channing, W. E.
 Collyer, Robert
 Freeman, James
 Frothingham, O. B.
 Hill, Thomas
 Parker, Theodore
 Savage, M. J.
 Ware, Henry

- (j) **UNIVERSALIST:**
 Universalism
 Rely, James
 Murray, John
 Ballou, Hosea
 Hanaford, Phebe A.

- (k) **MORMON:**
 Mormons
 Smith, Joseph
 Pratt, Orson
 Rigdon, S
 Taylor, John
 Woodruff, W.
 Young, Brigham

- (l) **OTHER DENOMINATIONS:**
 Adventists
 Miller, William
 Christian Catholic Church
 Christians
 Christian Science
 Disciples of Christ
 Eddy, Mary Baker Glover
 Evangelical Alliance
 German Baptist Brethren
 German Evangelical Protestant
 Church
 German Evangelical Synod of
 North America
 Institutional Church
 Moravians
 Brethren, Bohemian

Huss, John
 Comenius, J. A.
 Zinzendorf, Nikolaus
 Reformed Church in the United
 States.
 United Brethren in Christ
 Otterbein, P. W.
 Evangelical Association

III. MOHAMMEDANISM.

The history of Islam is closely connected with the history of the nations which adopted it as their creed. Though the spread of Mohammedanism has at all times been to some extent due to missionary zeal, its extension has largely been coincident with conquests. The political aspect of Moslem history may be best studied under the names of Mohammedan nations, dynasties, and rulers, such as ABBASIDES, OMMIADS, SELJUKS, TURKEY, ARABIA, etc. Here are only given the leading titles dealing with the religious development and present character of the faith.

For the Rise of Islam, see:

Mohammed
 Mohammedanism
 Mohammedan Sects
 Islam
 Mecca
 Medina
 Hejira
 Ayeshah

For the successors of Mohammed and early conquerors who spread the gospel of Islam in Asia, Africa, and Europe, see:

Caliph
 Abu-Bekr
 Omar

Othman
Ali
Omniads
Khalid
Musa ibn Nusair
Amr ibn al-Asi
Tarik
Idrisites
Aghlabids
Fatimites
Almoravides
Almohades

For the tenets and practices of the faith, in addition to the titles already quoted, see:

Koran
Sunna
Hadith
Kaaba
Hajj
Hajji
Fast
Ramadan
Beiram
Muharram
Kiblah
Houri
Jinn
Iblis

Imam
Mufti
Muezzin
Ulema
Madrasah
Marabouts
Mosque

For Sects and Parties, see:

Sunnites
Shiites
Hasan and Husain
Mahdi
Nosairians
Assassins
Druses
Hakim ibn Allah
Mutazilites
Sincere Brethren
Wahabis
Dervish
Babism
Sufism
Senussi

For Mohammedan Theologians:

Abu Hanifah
Ibn Hanbal
Ibn Tumart
Ghazali

Chapter 7. Education

THE study of the science of education is peculiarly related to the study of the growth and development of the intellectual, moral, and spiritual life of the human race. Every department of knowledge is necessarily in some way connected with the science of education. Most of the great thinkers of all ages have contributed to the literature of the science, and consequently many names must be included in our list of educators which appear, as well, in some other field. As part of some one philosophical system or another, education goes back to early times, but its history as an independent science, separated from philosophy or theology, is quite recent. Its problems, too, have grown immeasurably more complex with the progress of democratic ideals and the widening of its sphere of interest. More even than national defense, the fostering of public education has come to be the great function of the modern State; and, though differences of opinion prevail as to how far this obligation extends in practice, in all progressive countries there is no class of men whom the government, in one way or another, does not attempt to supply with the means of education.

There are three sides from which students may approach the study of the science: the historical, the psychological, and the pedagogical.

The History of education is outlined in the Article EDUCATION, which traces its development from the dawn of civilization to the present day. A more detailed study of the subject may be systematically pursued in the following lists of articles. The subject is usually divided into four periods: Pre-Christian (including the Oriental and the Classical types), Early Christian, Mediæval, and Modern.

I. THE PRE-CHRISTIAN PERIOD.

(a) The several types of Oriental education are discussed in the following articles:

Confucius
Buddhism
Caste
Jews
Talmud
Rabbi
Mohammedanism
Ulema
Mufti
Madrasah

they strove to attain their ideals, are discussed under the following heads:

Sophists
Socrates
Plato
Aristotle
Xenophon
Cyropædia
Sparta
Games
Plutarch
Quintilian

II. THE EARLY CHRISTIAN PERIOD.

(b) The aims of Greek and Roman educators, and the methods by which

The part played by the early Christian Fathers in the furtherance of education and the establishment of schools will be found under:

Catechumens
Catechetical Schools

Chrysostom
Basil the Great
Clement of Alexandria

Origen
Theodore of Mopsuestia

For the struggle between the pagan
and early Christian educators, see:

Tertullian
Augustine

These bring the student up to the
Mediæval period.

III. THE MEDIÆVAL PERIOD.

In the series of articles dealing with
this period, the student will find an
account of the efforts made by
the Church to promulgate education
throughout Christendom, and will be
led up to the modern movement, which
properly co-extends with the movement
that led up to and through the Refor-
mation. See:

Monasticism
Benedictines
Arts, Liberal
Quadrivium
Trivium
Scholasticism
Charles the Great
Alcuin
Alfred the Great
Abélard
Chivalry
University

IV. THE MODERN PERIOD.

Educational progress was hastened
and turned into varying channels by
the revival of the old learning. The
Reformation initiated the separation of
education from theology, and, by
breaking up the unit of European cul-
ture, gave rise to national systems of

education and the use of the national
vernaculars as the medium of instruc-
tion. For the early educational re-
formers, see:

Renaissance
Humanism
Dante
Petrarch
Boccaccio
Poggio Bracciolini
Pico della Mirandola
Poliziano
Reuchlin
Erasmus
Budæus
Scaliger, J. J.
Scaliger, J. C.
Casaubon, I.
Hardouin, J.
Reformation, The Protestant
Luther
Melanchthon
Sturm, Johannes
Ascham, Roger
Rabelais
Montaigne
Bacon, Francis
Induction
Ratichius
Comenius
Orbis Pictus

The efforts of the Catholic Church
to counteract the effects of the Refor-
mation may be studied in the following
articles:

Ignatius of Loyola
Jesuits
Ratio Studiorum
Jansenism
Port-Royal-des-Champs

For the activity of the Church in
supplying education to the very young,
see:

La Salle, Jean Baptiste de
 Brothers of the Christian Schools

For writers who contributed to the advancement of the science of education, see:

Milton, John
 Locke, John
 Fénelon, François

The realistic movement in education begins with **FRANCKE**, and the *Realschule* had its inception in his efforts. The movement culminates in the thorough sweeping away of old methods and ideas in education, foreshadowed in Rousseau's protest in his *Emile*. See:

Francke, A. H.
 Rousseau
 Emile
 Basedow
 Pestalozzi
 Girard, J. B.
 Jacotot
 Fröbel
 Kindergarten
 Herbart
 Mann, Horace
 Spencer, Herbert
 Arnold, Thomas
 Bell, Andrew
 Lancaster, Joseph

The systems of education prevalent in Europe and America are treated with great minuteness in the article on **NATIONAL EDUCATION, SYSTEMS OF**. The subject is further amplified in the sections on Education of the articles on the various countries of the world, wherein the statistical side is emphasized. The various phases of State activity receive full attention in the following articles:

Schools

Public Schools
 Evening Schools
 Secondary Schools
 High Schools
 Grammar Schools
 Gymnasias
 Realschule
 Women, Education of
 Negro Education
 Industrial Schools
 Vacation School
 Education, Colonial

V. PEDAGOGY.

Pedagogy is that branch of the science of education which deals with the methods and means of carrying out educational ideas. The old and the new educational methods receive comprehensive treatment in the article **PEDAGOGY**, which is amply supplemented by the following articles:

Nature-Study
 Child Psychology
 Object Teaching
 Curriculum
 Kindergarten
 Physical Training
 Manual Training
 Normal School
 Education, Commercial
 Technical Education
 Professional Education
 Theological Education
 Medical Education
 Legal Education
 Agricultural Education
 Seminar
 Privat-Dozent
 Reading
 Spelling

VI. EDUCATIONAL INSTITUTIONS.

The growth of colleges and universities in Europe and America is treated from the general standpoint in the

article on **UNIVERSITY**. This is supplemented by separate accounts of all of the important colleges and universities in the world. The list of American colleges and universities is especially complete; to such an extent, indeed, that mention may be made of only a few of the most prominent. See:

University
College
Colleges, American
Carnegie Foundation
General Education Board
Curriculum
Elective Courses
Degree
Diploma
Examination
Fellowship
University Extension
Harvard University
Yale University
Princeton University
Columbia University
Pennsylvania, University of
Brown University
Cornell University
Johns Hopkins University
Clark University
Chicago University
Leland Stanford Junior University
Catholic University of America
Amherst College
Bowdoin College
Dartmouth College
William and Mary College
Williams College
Girard College
Carnegie Institution

The State universities have all been written up in detail.

For a group of women's colleges in the United States, see:

Barnard College
Bryn Mawr College
Goucher College
Mount Holyoke College
Radcliffe College
Smith College
Vassar College
Wellesley College

In this connection see also:

Collegiate Education of Women
Coeducation

For English universities and schools, see:

Oxford University
Rhodes Scholarships
Cambridge, University of
London University
Liverpool, University of
Manchester, University of
National University of Ireland
Dublin University
Girton College
Newnham College
Eton College
Rugby School
Harrow School
Shrewsbury School
Winchester College

For the greatest of European universities, either in present importance or historically, see:

Paris, University of
Berlin, University of
Vienna, University of
Madrid, University of
Munich, University of
Moscow, University of
Leipzig, University of
Edinburgh, University of
Heidelberg, University of
Bologna, University of
Padua, University of

Salerno, School of
Coimbra, University of
Salamanca, University of
Montpellier, University of
Prague, University of

A partial list of prominent educators of the modern times includes:

Adams, C. K.
Ames, J. B.
Andrews, E. B.
Angell, J. B.
Arnold, T.
Barnard, F. A. P.
Barnard, Henry
Bascom, J.
Brown, E. E.
Butler, N. M.
Clayton, P. P.
De Garmo, C.
Dewey, John
Drisler, Henry
Eliot, C. W.
Gildersleeve, B. L.
Gilman, D. C.
Hadley, A. T.
Hadley, James
Hall, G. S.
Hanus, P. H.
Harkness, A.
Harper, W. R.
Harris, W. T.
Hill, D. J.
James, E. J.
James, W.

Jebb, Sir R. C.
Jordan, D. S.
Jowett, B.
Low, Seth
Lyon, Mary
McCosh, J.
McMurry, F. M.
Monroe, Paul
Pattison, Mark
Patton, F. L.
Quick, R. H.
Sadler, M. E.
Schurman, J. G.
Sidgwick, Mrs.
Washington, Booker T.
Wendell, Barrett
West, Wm. A.
Wheeler, B. I.
White, A. D.
Whitney, W. D.
Wirt, Wm. A.
Young, Ella Flagg

For classes of institutions that have become centres for the spread of popular education, see:

- (a) Libraries:
 - New York Public Library
 - Book
 - Alexandrian Library
 - Bodleian Library
 - British Museum
 - Bibliothèque Nationale
 - Library of Congress
- (b) Museum

8. Philosophy and Psychology

THOUGH great diversity exists as to the meaning and scope of the term Philosophy, two definitions may be given as representative. The more modern view regards philosophy as the sum of all scientific knowledge, or the systematization of results obtained in the individual sciences; the historical and more prevalent view looks upon philosophy as the search for the ultimate nature and meaning of the universe, and especially of human life. Embracing at one time the totality of scientific knowledge, the field of philosophy has steadily grown narrower with the erection of independent sciences, until at the present day it includes the studies of metaphysics, logic, ethics, and æsthetics. Psychology is the latest branch of investigation to achieve its emancipation from philosophy, whose methods, historically, have been quite different from those that prevail in the scientific world to-day.

I. 1. The problems of philosophy are best studied, perhaps, historically. A brief summary, however, in necessarily technical language, will serve to present the main outlines of the subject in the form in which they have appeared to thinkers of different ages. Generally, then, the problems of philosophy are divided into three classes: those which deal with the ultimate nature of the universe, grouped under the heading **METAPHYSICS**; those which deal with the forms of human knowledge and its relation to reality, known as epistemology, or the theory of knowledge; and those dealing with human conduct, included in the science of ethics. See:

Philosophy
Metaphysics
Knowledge, Theory of
Ethics

2. The inquiry into the nature of reality takes on two forms: that concerned with the ultimate nature of things, and that dealing with the connection between things, or the architectural plan of the universe.

(a) For the First, see:

Ontology
Dualism
Monism
Materialism
Mechanism
Realism
Idealism

(b) For the Second, see:

Atomism
Theism
Transcendentalism
Pantheism
Body and Mind
Parallelism
Substance
Form
Causality
Time
Space
Teleology
Infinite
Absolute

3. In connection with our knowledge of the universe, two questions arise:

(a) Taking the conglomeration of ideas we call knowledge, is there an outside Reality corresponding to them,

or are they Reality itself; and (b) are these ideas in origin the result of experience, or are they independent of experience? See:

- (a) Realism
 - Idealism
 - Skepticism
- (b) Empiricism
 - Rationalism
 - A priori
 - Dialectic
 - Category
 - Induction
 - Deduction

II. 1. The history of European philosophy begins with the Greeks, in whom, however, strong Oriental influences are traceable. Their earliest philosophy was a nature philosophy, and its two great problems were those of Being and Becoming. See:

- Greek Philosophy
 - Thales
 - Anaximander
 - Anaximenes
 - Eleatic School
 - Xenophanes
 - Parmenides
 - Zeno (the Eleatic)
 - Gorgias
 - Heraclitus
 - Pythagoras
 - Pythagoreanism
 - Neo-Pythagoreanism
 - Archytas
 - Metempsychosis
 - Empedocles
 - Anaxagoras
 - Atomism
 - Leucippus
 - Democritus

2. In the second period, the main interest of philosophy becomes anthro-

pological or ethical, the tendency being most fully apparent in the figure of the great teacher Socrates, from whom descend the great schools of the Hellenistic world, Platonists, Stoics, Hedonists, Cynics. Plato and Aristotle by their genius moulded almost the channels in which philosophic thought was to flow in the future. Greek philosophy, toward its end, exerted a powerful influence on Christianity. See:

- Sophists
 - Protagoras
 - Socrates
 - Hedonism
 - Cyrenaic School
 - Aristippus
 - Hegesias
 - Epicurus
 - Epicureanism
 - Lucretius
 - Stoics
 - Zeno (the Stoic)
 - Cleanthes
 - Chrysippus
 - Seneca
 - Epictetus
 - Aurelius, Marcus
 - Cynics
 - Antisthenes
 - Diogenes
 - Euclid (of Megara)
 - Plato
 - Academy
 - Arcesilaus
 - New Academy
 - Carneades
 - Aristotle
 - Peripatetic Philosophy
 - Pyrrho
 - Ænesidemus
 - Sextus Empiricus
 - Skepticism

Neo-Platonism
 Philo Judæus
 Ammonius
 Plotinus
 Porphyrius
 Iamblichus
 Proclus
 Boëthius
 Anima Mundi
 Logos
 Eclecticism
 Cicero

3. From the Platonic philosophy, as contained in the writings of the Christian Fathers, mediæval philosophy developed into the system known as Scholasticism, which in its fullest development, however, became Aristotelian, through the influence of the Arabian philosophers. Philosophy became the handmaiden of theology, and it supported the mysteries of the Christian faith by means of a subtle dialectic. The downfall of scholasticism began with the fourteenth century, and was hastened by the Revival of Learning. See:

Scholasticism
 Augustine (of Hippo)
 Erigena
 Rabanus Maurus
 Peter Lombard
 Realism
 Anselm of Canterbury
 Guillaume de Champeaux
 Nominalism
 Roscelinus
 Durandus
 Occam, William of
 Buridan, Jean
 Ailly, Pierre d'
 Concept
 Abélard
 Averroës

Avicenna
 Albert of Bollstädt
 Alexander of Hales
 Vincent of Beauvais
 Aquinas, Thomas
 Duns Scotus
 Suárez, Francisco
 Mysticism
 Hugo of St. Victor
 Bernard of Clairvaux
 Bonaventura, St.
 Eckhardt
 Tauler
 Kempis
 Böhme
 Quietism
 Molinos
 Bacon, Roger
 Lully, Raymond
 Cusa, Nikolas
 Renaissance

The Revival of Learning brought about a temporary revival of the classic philosophies, but these served only to bridge over the chasm between the ancient thought and the modern philosophy, whose beginning dates from the establishment of Empiricism by Bacon and Rationalism by Descartes. The subjects of Substance and Causality now assume leading importance. Cartesian rationalism ends in dogmatism on the Continent; empiricism ends in skepticism in England. See:

Bruno, Giordano
 Campanella, T.
 Gassendi
 Rationalism
 Descartes
 Malebranche
 Occasionalism
 Spinoza
 Pantheism
 Leibnitz

Preëstablished Harmony

Monad

Wolff, Christian

Baumgarten, A. G.

Eberhard, J. A.

Mendelssohn, Moses

Vico, G. B.

Empiricism

Hobbes, Thomas

Locke, John

Sensationalism

Clarke, Samuel

Butler, Joseph

Paley, William

Berkeley, George

Cambridge Platonists

Cudworth, Ralph

More, Henry

Hume, David

Charron, Pierre

Toland, John

Hartley, David

Priestley, Joseph

Condillac

La Mettrie

Diderot

D'Alembert

Helvétius

Holbach

Cabanis, J. P. G.

Genovesi, A.

Enlightenment, Philosophy of the

Common Sense, Philosophy of

Reid, Thomas

Beattie, James

Stewart, Dugald

Hamilton, William

The critical philosophy of Kant sought to mediate between Rationalism and Empiricism by assigning to either its proper function in the mental life; and, though Kantianism was followed by the rise of great rationalistic systems in Germany, in which the

balance was overthrown anew, the teachings of the Königsberg philosopher have shown the greater vitality as being in consonance with the spirit of the growing sciences. Reaction against unrestrained idealism led to Positivism, in which philosophy becomes a correlation of sciences. Materialism, after a brief popularity, seems to have passed away forever. See:

Kant

Herder

Jacobi, F. H.

Hamann, J. G.

Krause, K. C. F.

Reinhold, C. E.

Rosenkranz, K.

Erdmann, J. E.

Trendelenburg

Zeller, E.

Ulrich, H.

Fischer, Kuno

For the important systems that arose after Kant, see:

Fichte, J. G.

Fichte, I. H.

Schelling

Hegel

Feuerbach, L. A.

Green, T. H.

And for a philosophy of will that has exercised a profound influence on modern thought:

Schopenhauer

Pessimism

Hartmann, Karl Robert

Materialism was fostered by the doctrine of evolution and the Darwinian discoveries. See:

Moleschott, J.

Büchner, F. L.

Vogt, Karl

Haeckel, E.

For the neo-Kantianism of the latest scientific thought, see:

Lange, F. A.
Cohen, Herman
Du Bois-Reymond, E. H.
Helmholtz
Virchow
Wundt
Renan
Taine

For systematic attempts at reconciling philosophy and religion, see:

Schleiermacher
Ritter, Heinrich
Rosmini-Serbatì
James, Wm.

For philosophies that have been made the basis of important pedagogical psychologies, see:

Herbart
Flügel, O.
Beneke
Lotze
Fechner
Paulsen, Friedrich

Spiritualism had influential exponents in France in the beginning of the nineteenth century. See:

Royer-Collard
Cousin, Victor
Maine de Brian
Jouffroy, T. S.
Psychical Research
Myers, F. W. H.

Spiritualism found its reaction in the epoch-making work of Comte. See:

Positivism
Agnosticism
Comte
Littré
Mill, J. S.

Spencer, Herbert
Lewes, G. H.
Harrison, Frederic
Riehl, A.

For philosophic thought in America, see:

Edwards, Jonathan
Transcendentalism
Emerson, R. W.
Ripley, G.
Alcott, A. B.
Channing, W. E.
Thoreau, H.
McCosh, J.
Harris, W. T.
Royce, J.
James, Wm.
Ladd, G. T.
Dewey, J.

Every well-rounded philosophical system has its logic, ethics, and æsthetics, and strictly speaking these cannot be divorced from the discussions of purely metaphysical problems. Nevertheless, as important subdivisions of philosophy, they have received an amount of attention that give them independent consideration.

A. The problems of human conduct are discussed minutely in the general article on **ETHICS**, and further differentiated in subsidiary articles. See:

Ethics
Will
Free Will
Casuistry
Chance
Fatalism
Determinism
Indifferentism
Egoism
Altruism
Energism

Eudæmonism
 Intuitionism
 Categorical Imperative
 Utilitarianism
 Hutcheson
 Bentham, J.
 Austin, J.
 Mill, J. S.
 Nietzsche, F.
 Stephen, Leslie
 Sidgwick, H.
 Martineau, J.
 Green, T. H.
 Caird, E.
 Alexander, Samuel
 Fouillée
 Simmel, G.

B. The formal rules of thought as outlined by Aristotle have received modifications at the hands of both rationalists and empiricists, the influence of the latter being, however, the more pronounced on the development of the science. See:

Logic
 Knowledge, Theory of
 Induction
 Deduction
 Argument
 Syllogism
 Analysis
 Synthesis
 Abstraction
 Hypothesis
 Judgment
 Definition
 Division
 Percept
 Concept
 Connotation
 Denotation
 Obversion
 Opposition
 Comparison

Analogy
 Identity, Law of
 Fallacy
 Dilemma
 Mill J. S.
 Jevons
 Whately, R.

C. The separate science of æsthetics dates only from the eighteenth century. Its latest development has been along experimental and anthropological lines. See:

Æsthetics
 Æsthetics, Experimental
 Baumgarten, A. G.
 Lessing, G. E.
 Shaftesbury, third Earl of
 Hogarth
 Bain
 Bosanquet
 Santayana, George

D. The psychology of the present differs from earlier investigations of the human mind in its application of a more rigorous scientific method. It assumes no metaphysical substratum for mental life, but is content to take experience as its ultimate fact and to study its forms and manifestations. Though the science is to be dated only from the latter half of the nineteenth century, it has already been found necessary to divide the field of investigation for the purpose of the more effective study of the mind of the adult, the child, and the abnormal individual, and the collective mind of the crowd. The method of psychology is ultimately introspective, but it is introspection carefully pursued and corrected by the standard of the scientific average. For classification and methods, see:

Psychology

Individual Psychology
Genetic Psychology
Child Psychology
Social Psychology
Folk-Psychology
Insanity
Psychology, Experimental
Psychological Apparatus
Psychophysics
Introspection
Phrenology

Intensity of Sensation
Extension
Duration
Quality
Discrimination, Sensible
Contrast
Reaction
Weber's Law
Limen
Relativity, Law of

(c) For a Classification of Sensations,
see:

With mental experience as basis for analysis, psychology finds that the analytical element of mental life is sensation, and sensations depend on bodily processes set in motion by external stimuli. Sensations are classified according to the organs whose stimulation they accompany. For mind in general, and its relation to body, see:

(a) Mind
Elements, Conscious
Mental Process
Self
Self-Consciousness
Unity of Consciousness
Double Consciousness
Sleep
Dreaming
Hypnotism
Autosuggestion
Somnambulism
Consciousness
Noetic Consciousness
Meaning
Body and Mind
Subconsciousness
Subliminal Consciousness
Cerebration, Unconscious

Vision
Visual Sensation
Blind Spot
After-images
Illusion
Mirage
Hallucination
Clairvoyance
Apparition
Color
Saturation
Color-Blindness
Audition
Clang-Tint
Colored Hearing
Fusion
Smell
Taste
Touch
Cutaneous Sensations
Static Sense
Muscle Sense
Muscle-Reading
Pain
Fatigue
Common Sensation
Organic Sensations

(b) For Sensation, see:
Sensation
Sensorium

From simple sensations the higher intellectual processes (perception, idea, association of ideas, etc.) are synthesized. A corresponding process has

been brought forward as the analytical element of our emotional life, and has been denominated Affection. From a combination of sensational and affective elements arise the various processes classified under the general designation, Will. It is thus that the new psychology improves upon the threefold division of Intellect, Reason, and Will in the older psychology. See:

Affection
Conation
Attention
Effort
Interest
Tendency
Disposition
Faculty
Mental Constitution

(a) For the Complex Sensational Processes:

Perception
Idea
Movement, Perception of
Locality, Perception of
Distance, Perception of
Figure
Rhythm
Melody
Association of Ideas
Retention
Reproduction of Ideas
Memory
Apperception
Recognition
Familiarity
Apprehension
Imagination
Judgment
Ratiocination
Understanding
Abstraction

Intellect

(b) For the Affective or Emotional Processes:

Feeling
Emotion
Mood
Temperament
Mental Constitution
Sentiment
Sympathy
Antipathy
Fear
Anger
Belief
Expectation
Expression
Laughter
Language
Gesture

(c) For the Will Processes:

Will
Action
Instinct
Impulse
Desire
Habit
Practice

In the field of experimental investigation, Germany holds the first rank. Excellent work has been done in France, especially in the field of abnormal psychology, and in England and America, where German thought has blended with the native empiricism. See:

- (a) Weber, E. H.
Fechner, G. T.
Helmholtz, H.
Hering, E.
Flehsig, P. E.
Stumpf, K.
Müller, G. E.

- Wundt, W.
(b) Bain, Alexander
Romanes, G. J.
Galton, F.
Stout, G. F.
Sully, James
(c) Binet, A.
Charcot, J. M.

- Ribot, T. A.
(d) James, William
Ladd, G. T.
Münsterberg, H.
Dewey, John
Titchener, E. B.
Baldwin, J. M.
Hall, G. S.

Chapter 9. Language and Literature

THE tracing of the mutual relations of the various languages of the world, and the study of their similarities and differences, is the task of the science of comparative philology. The phonetic, or mechanical side, the inflectional, or constructive, and the syntactic, or psychological aspect, are the three factors which combine to form human speech. See:

A. Language

1. PHILOLOGY.

Philology
Grammar
Dialect
Phonetics
Accent
Phonetic Law
Grimm's Law
Verner's Law
Etymology
Grassman's Law
Inflection
Declension
Comparison
Nouns
Name
Gender
Adjective
Pronoun
Article
Adverb
Preposition
Conjunction
Interjection
Verb
Participle
Conjugation
Reduplication
Ablaut
Umlaut
Syntax, Figures of
Sentence
Semasiology

Slang
Metaphor
Orthography, Figures of
Prosody
Rhyme
Assonance
Alphabet
Inscriptions
Paleography
Runes
Spelling
Rhetoric
Pronunciation
Phonetics

2. For a classification of languages in related groups, see:

(a) *For the Monosyllabic Type:*
Chinese Language

(b) *For the Agglutinative Type:*

African Languages
Egyptian (under Egypt)
Coptic (under Copts)
Ural-Altaic
Finnish Language
Turkish Language
Japanese Language
Dravidians
Tamils
Telugus
Philippine Languages

- (c) *For the Polysynthetic Type (Incorporating):*
 American Indian (under Indians, American):
- (d) *For the Inflectional Type:*
 Semitic Languages
 Cuneiform Inscriptions
 Aramaic
 Syriac Language
 Samaritan Language
 Moabitish Language (under Moabite Stone)
 Arabic Language
- Inflectional also are:
- (i) Indo-Germanic Languages
- (ii) The Languages of India:
 Sanskrit
 Pali
 Prākṛit
 Assamese (under Assam)
 Bengali
 Ceylonese (under Ceylon)
 Gujarātī
 Hindustani
 Kashmiri
 Maldive
 Marathi
 Panjabi
 Sindhi
 Uriya
- (iii) The Iranian Languages:
 Iranian Languages
 Old Persian
 Avesta
 Pahlavi
 Persian
 Afghan
 Baluchi
 Kurdish
 Ossetic
- (iv) Armenian
- (v) Albanian
- (vi) Mediterranean Languages:
 Greek
 Italic Languages
 Latin
 Italian
 Spanish
 Norman French
 French
 Provençal
 Rumanian
 Portuguese
- (vii) The Teutonic Languages:
 Teutonic Languages
 Gothic
 Icelandic
 Norwegian
 Swedish
 Dutch
 German
 Plattdeutsch
 Frisian
 Flemish
 Anglo-Saxon
 English
 Americanisms
- (viii) The Celtic Languages:
 Celtic Languages
 Cornish
- (ix) The Balto-Slavic Languages:
 Old Prussian
 Lettic
 Lithuanian
- (x) The Slavic Languages:
 Slavic Languages
 Old Church Slavic
 Polish
 Russian
 Czech or Bohemian Language
- See also:
 International Languages
 Esperanto
 Volapük

3. For the great names in the field of comparative philology, see:

Ascoli, G. I.

Bopp, F.

Brugmann, F. K.

Breal, M.

Bugge, S.

Burnouf, E.

Grimm, J. L. K.

Grundtvig, S. H.

Kölbing, E.

March, F. A.

Menéndez Pidal, R.

Meillet, A.

Paris, G.

Pott, A. F.

Rask, R. K.

Rousselot, Abbé

Schlegel, F.

Schleicher, A.

Schmidt, J.

Sievers, E.

Skeat, W. W.

Stokes, W.

Sweet, H.

Thomas, André Antoine

Taylor, W.

Verner, K. A.

Vigfusson, G.

Webster, Noah

Whitney, W. D.

Zeuss, S. C.

B. Literature

Literature, which is the expression, more or less permanent, in language, of human thought and emotions, would include in its widest sense every written record of man's activity, the university man's dissertation on the Coleoptera no less than Shelley's "Ode to the Skylark." Such a wide connotation of the term would render any classification within reasonable space limits impossible, and in the present chapter the matter has been restricted to the treatment of what we ordinarily call *Belles-lettres*. The great works in history and the various fields of science and philosophy will be accounted for in the chapters with the subject matter of which they are more intimately connected. A more considerable difficulty than that of settling limits to the scope of the term literature is that of determining a reasonably fixed standard of classification, owing to the twofold aspect under which

every literary monument presents itself—as form or matter. Taking, for instance, any specific department of literature, such as satire, we find that our satirist may be, as regards form, a lyrist, novelist, essayist, or dramatic writer. The man we call poet may, in the same manner, have turned the poetic form to the uses of comedy or of the lyric spirit. Again, commonly, a literary artist will have attained eminence in different categories of literature, as the drama, say, criticism, and poetry, and the necessity arises of partially and often arbitrarily characterizing such a man. A certain measure of violence is, therefore, unavoidable when the attempt is made to cast any great literary figure into a rigidly labeled department; but there is sufficient justification for the scheme in the fact that, as a rule, the great literary figure does stand out pre-eminently in one department of the art,

and, remembering that the line of division is by no means rigid, we may classify him accordingly.

The historical study of literature may be pursued in two ways. There is the vertical order, as it may be called, in which we take up the national literatures one by one, a method of study in which the various literary genres are considered at the same time, and wherein the formal side is naturally subordinated to the investigation of the development of national character as revealed in the national literature. There is also what may be called the horizontal order, where our attention is confined to one kind of literature at a time, whose development is traced from the beginning to the present day, across national boundaries, the process essentially being one of thematic unity, as compared with the preceding method of national unity. Either method has its advantages, and the material in the *New International Encyclopædia* has been so treated as to lend itself to either form of study; but, whereas the student or reader who would devote himself to the study of national literatures may be left to his own resources in view of the obvious classification followed, the need for guidance is apparent in the second. Emphasis, therefore, in the present chapter is laid on the formal development of the literary form, the underlying principle being the belief that the larger number of students are apt to turn to a specialized subject, like the history of the novel or the epic, rather than to the expanded story of an entire national literature.

I. THE NATIONAL LITERATURES.

American Literature

Arabic Language and Literature
 Armenian Language and Literature
 Australian Literature
 Bengali Language and Literature
 Breton Literature
 Canadian Literature
 Catalan Language and Literature
 Chinese Language and Literature
 Cuban Literature
 Czech Literature
 Danish Language and Literature
 Dutch Literature
 Egyptian Language and Literature
 (under Egypt)
 English Literature
 Finnish Language and Literature
 Flemish Language and Literature
 French Literature
 Frisian Language and Literature
 German Literature
 Greek Literature
 Hindustani Language and Literature
 Hungarian Literature
 Icelandic Literature
 Iranian Languages and Literatures
 Irish Literature
 Italian Literature
 Japanese Literature
 Jewish Language and Literature
 (under Jews)
 Latin Literature
 Lettic Language and Literature
 Lithuanian Language and Literature
 Mexican Literature
 Norwegian Literature
 Old Church Slavic Language and Literature
 Pahlavi Language and Literature
 Persian Literature
 Polish Literature
 Portuguese Literature
 Portuguese-Brazilian Literature

Romance Literatures

Rumanian Language and Literature

Russian Literature

Scottish Language and Literature

Spanish Literature

Spanish-American Literature

Swedish Language and Literature

Syriac Language and Literature

Turkish Language and Literature

Yiddish

II. THE LITERARY FORMS. The broadest subdivision in literature according to form is that into prose and poetry; and, though it is often very difficult to differentiate one from the other in fact, and always hard to describe the distinction between them in theory, the common definitions of prose as the ordinary mode of speech and poetry as speech figurative, cadenced, and cast within certain comparatively rigid forms, may be followed safely enough for practical purposes. Either, taken in itself, may be subdivided into forms of narrower connotation, such as essay and novel under prose, epic and lyric under poetry. Here, however, appears the inconsistency already mentioned as inherent in literary classification; for the earliest scientific essays of the Greeks were written in verse, while Walt Whitman's lyric spirit finds expression in a medium closely akin to Ruskin's fervid prose. Again, the drama is probably nowadays regarded as a prose form, though as a matter of fact the world's greatest plays bear the poetic form. Poetry, then, if we exclude the drama, embraces the two subdivisions of the epic and the lyric. In the history of literary development, poetry precedes

prose, and of the two poetic forms the epic, as a rule, antedates the lyric.

1. EPIC POETRY. The epic may be defined as a lengthy narrative in verse, dealing with a subject of great magnitude in character, national or descriptive of a great movement. A distinction may be made between the epic which is the spontaneous expression of national life, constructed at an early period in national development out of pre-existing minor poetic forms, and the artificial epic of a more advanced cultural stage, which is the work of a single mind and in consequence purposive in its nature rather than spontaneous. Mention should also be made of the mock or beast epic, in nature largely satirical. See **EPIC POETRY**; and, for the great epics and epic poets of the world's literature, the following titles:

SANSKRIT:

Mahabharata

Rāmāyana

Purana

PERSIAN:

Firdausi

Shah Namah

Rustam

GREEK:

Homer

Age of Epic Poetry (under Greek Literature)

Cyclic Poets

LATIN:

Vergil

Æneas

Lucan

Silius Italicus

Statius

FRENCH:

Chansons de geste

Roland
 Aymon
 SPANISH:
 Cid, The
 Ercilla y Zúñiga

GERMAN:
 Nibelungenlied
 Klopstock

ITALIAN:
 Dante
 Boiardo
 Ariosto
 Tasso

PORTUGUESE:
 Camões

NORSE:
 Edda
 Saga

FINNISH:
 Kalevala

ENGLISH:
 Beowulf
 Milton

THE BEAST EPIC:
 Homer; Greek Literature
 Reynard the Fox

2. THE LYRIC. Lyric poetry, as the expression of personal feeling, is the most subjective of all literary forms. Originally written to be sung, the lyric has remained the nearest approach in literature to absolute music. Its scope is as wide as human emotion, broadening in the course of its development with the expansion of human sympathies. Its formal variations are numerous. See:

 Lyric Poetry
 Versification
 Sonnet

Ode
 Ballade
 Rondeau
 Madrigal
 Canzone
 Rhyme
 Vers Libre

Lyric poetry attained great perfection in ancient Greece, though its field was narrower than that of modern poetry for comparative lack of the nature element, which, with us, is so conspicuous a feature of lyric expression. The Roman genius was, on the whole, unfavorable to the fostering of the lyric spirit. In the East, Persia produced a succession of poets of great excellence. See, for the great names in the realm of lyric poetry:

SANSKRIT:
 Kalidasa

PERSIAN:
 Nizami
 Omar Khayyam
 Sadi
 Hafiz
 Jāmi

LATIN:
 Catullus
 Tibullus
 Horace
 Ovid
 Propertius
 Ausonius
 Prudentius

GREEK:
 Alcman
 Callinus
 Archilochus
 Tyrtaeus
 Simonides
 Solon

Alcæus
Sappho
Anacreon
Theognis
Hipponax
Pindar
Bacchylides
Timotheus
Theocritus
Bion
Moschus
Herondas

The lyric poetry of the Middle Ages was largely ecclesiastical, the Latin hymns of the period being especially marked by extraordinary effects of rhyme. The court singers of France and Germany, however, fostered the love theme assiduously. With the Revival of Learning came a great impetus to the poetic expression of secular emotions, Italy being the first to feel the impulse of the new movement. Lyricism languished during the domination of classical ideals in the seventeenth and eighteenth centuries, but, freed from the bond of artificiality, entered upon an unprecedented development towards the end of the latter century. See:

Hymnology
Troubadours
Trouvère
Minnesinger
Meistersinger
Goliardic Literature
Romanticism;
and for the lyric poets of Western Europe:

FRENCH:

Marie de France
Meung, Jean de
Villon

Marot
Malherbe
Pléiade
Ronsard
Chénier, Andre Marie
Chénier, Marie Joseph
Béranger
Lamartine
Delavigne
Hugo
Musset
Gautier
Leconte de Lisle
Baudelaire
Hérédia, José
Sully-Prudhomme
Verlaine
Mallarmé
Regnier, H.
Rimbaud, J. A.
Kahn, Gustave

PROVENÇAL:

Roumanille
Jasmin
Mistral, F.
Gras, Félix
Félibrige

ITALIAN:

Cavalcanti, Guido
Cino da Pistoja
Dante
Petrarch
Colonna, Vittoria
Guarini
Marini
Chiabrera
Metastasio
Bondi, Clemente
Foscolo, Ugo
Leopardi
Monti, V.
Aleardi
Giusti, Giuseppe

Carducci

Graf, A.

SPANISH:

Lopez de Ayala, Pedro

Santillana

Carcilasso de la Vega

León, Luis de

Figuerola, Francisco de

Argensola

Mendoza, Diego Hurtado de

Góngora y Argote

Zorrilla y Moral

Iriarte y Oroposa

Lista y Aragon

Melendez Valdes

Espronceda

PORTUGUESE:

Ferreira, A.

Gomes de Amorim

GERMAN:

Walther von der Vogelweide

Sachs, Hans

Fleming, Paul

Opitz

Bürger

Kleist, E. C.

Goethe

Schiller

Schlegel, A. W.

Arndt

Novalis

Chamisso

Uhland

Körner

Eichendorff

Heine

Rückert

Freiligrath

Bodenstedt

Scheffel

Auersperg

Hamerling

Ambrosius, Johanna

DUTCH:

Marnix

Vondel

Bilderdijk

Kate, J. J. ten

Eeden, F. Van

FLEMISH:

Maerlant

Bijns

Conscience, H.

The lyric poetry of Northern and Eastern Europe is recent in origin, dating from the eighteenth century. It has, as a rule, been under the influence of the great literary movements of the West, but, though largely mimetic in form, has been made the expression of national consciousness. See:

SWEDISH:

Bellman

Tegnér

Atterbom

Runeberg

Snoilsky

DANISH:

Heiberg, J. L.

Evald

Richardt

NORWEGIAN:

Welhaven

Wergeland

HUNGARIAN:

Kisfaludy

Arany

Petőfi

Erdélyi

RUSSIAN:

Derzhavin

Pushkin

Koltsov

Lermontov

Sheftchenko

Nekrasov

POLISH:

Naruszewicz
Karpinski
Mickiewicz
Kniaznin
Slowacki
Krasinski
Pol
Asnyck

The origins of the English lyric poetry may be traced back, if it be so desired, to early Anglo-Saxon times. The continuous history begins with Chaucer. Some of the most beautiful lyrics of the language are embodied in the works of the Elizabethan dramatists, after whom, and Milton, the art declines and hardens until revived by Burns and Wordsworth. English lyric in the nineteenth century has covered the field of human sympathies, from Blake's unseen world to Tennyson's studies in evolution and Kipling's in machine construction. See:

ENGLISH:

Cædmon
Ormulum
Layamon
Lydgate, John
Minot, Laurence
Barbour, John
Gower
Chaucer
Sackville
Shakespeare
Jonson
Milton
Ramsay, Allan
Donne
Herrick
Herbert
Waller
Crashaw

Cowley
Vaughan
Gay
Savage, Richard
Chatterton
Shenstone
Young, Edward
Thomson
Gray
Collins
Cowper
Blake
Burns
Hogg
Wordsworth
Landor
Moore
Keats
Shelley
Praed
Proctor, B. W.
FitzGerald
Tennyson
Browning
Clough
Arnold, Matthew
Ingelow, Jean
Patmore
Rossetti, Dante Gabriel
Rossetti, Christina
Morris
Arnold, Edwin
Swinburne
Massey, G.
Henley
Watson, W.
Kipling
Meynell, A. C.
Sharp, W.
Yeats, W. B.

AMERICAN:

Freneau
Barlow, Joel

Key
Halleck
Bryant
Drake
Emerson
Whittier
Longfellow
Holmes
Poe
Lowell
Hoffman, C. F.
Whitman
Cary, Alice and Phœbe
Timrod
Howe, Julia Ward
Stedman
Aldrich
Lanier
O'Reilly, J. B.
Field, Eugene
Riley
Miller, Joaquin
Moody, William Vaughan

3. THE DRAMA. The Drama has been placed high among mimetic forms, because of the contribution it lays on the other arts, thus combining within itself their several qualities. Action and character are the subject matter. The means are bodily motion, which gives the sculptor's effect; language, which is the instrument of the poet; music, and scenery, and costume, to which painting and architecture give their share. The origins of the drama are to be found, most probably, in early religious ceremonial. Festivals marked by singing and dancing, the latter more or less symbolic in character, are common to peoples in a primitive stage; and the line of progress is along the development of the action and the spoken dialogue, at the expense of the

chant, to complete secularization of the drama. The principles of the drama as propounded by Aristotle have remained for the most part the same; the mechanical technique has varied widely from original conditions. See:

Drama
Theatre
Stage
Chorus
Act
Ballet
Burlesque
Farce
Interlude
Masque
Vaudeville
Pantomime
Puppet
Atellane
Mime
Prologue
Epilogue

Greek drama had its origin in the worship of Dionysus. With Æschylus, tragedy is profoundly religious, and the actor's speeches are still subordinated to the choruses; Sophocles strengthened the element of action; Euripides thoroughly humanized tragedy. Attic comedy was fierce in personal satire and unbridled in speech. The Latin drama was sedulously modeled on the Greek. The origin of the Sanskrit drama is disputed, some deriving it from the Greek, others assigning it an independent development. See, for writers and plays:

SANSKRIT:
Sūdraka
Kalidasa
Bhavabhūti
Śakuntalā
Mricchakatika

GREEK:

Æschylus
Phrynichus
Sophocles
Euripides
Aristophanes
Agathon
Epicharmus
Eupolis
Menander

LATIN:

Plautus
Terence
Seneca

In Mediæval times, practically the only species of dramatic performance was the religious spectacles of the Church, in which the purpose was didactic. See: **MIRACLE PLAY; MORALITY; INTERLUDE; PASSION PLAY.**

Out of the religious performances of the Middle Ages the modern drama developed. In France, which served as a model to the Continent, an elaborate system of rules was built up, supposedly bringing the drama into conformity with the standards of the classic age. The classic ideals, with their restriction of human emotions to kings and nobles, were overthrown on the Continent in the first half of the nineteenth century, since when the scope of the drama has been widened to embrace the entire complex of society. Like the novel, the drama of the latest days has become largely purposive. See, for the writers:

FRENCH:

Mairet
Regnard
Corneille
Racine
Molière

Marivaux

Chénier, M. J.
Crébillon
Beaumarchais
Scribe
Vigny
Hugo
Legouvé
Labiche
Ponsard
Augier
Dumas
Pailleron
Meilhac
Halévy
Sardou
Rostand
Maeterlinck
Brieux
Comédie Française

ITALIAN:

Trissino
Maffei
Goldoni
Gozzi
Alfieri
Manzoni
Giacometti
Annunzio, G. d'

SPANISH:

Encina
Vega Carpio
Calderon de la Barca
Moreto y Cabaña
Moratín, Leandro Fernández
Gil y Zárate
Lopez de Ayala, Adelardo
Hartzenbusch, J. E.
Echegaray
Breton de los Herreros

PORTUGUESE:

Sá de Miranda
Almeida-Garrett

The primacy in Continental drama, long held by the French, is disputed at the present day by the Teutons and the Slavs, more particularly the Scandinavian branch of the Teutons. See:

GERMAN:

Lessing
Goethe
Schiller
Kotzebue
Grillparzer
Laube
Gutzkow
Anzengruber
Heyse
Sudermann
Hauptmann
Lindau, P.
Hartleben
Fulda

SWEDISH:

Almqvist
Strindberg

DANISH:

Holberg
Oehlenschläger

NORWEGIAN:

Ibsen
Björnson

RUSSIAN:

Sumarokov
Griboedov
Gogol
Ostrovski
Zagoskin, M. N.
Tolstoy, Alexei
Tolstoy, Liov
Gorky

POLISH:

Fredro
Kniaznin
Fredro the Younger

HUNGARIAN:

Kisfaludy, Károly
Katona
Szigligeti

While Continental Europe was enslaved by the rigid formulas of the classicists, in England the Romantic drama flourished from the beginning. The Elizabethan age is the golden age of the drama of the world. Following the Elizabethans came the decline, arrested partially by the talent of Dryden and Congreve during the Restoration, and of Goldsmith and Sheridan in the later part of the eighteenth century. In the nineteenth century, England brought forth no dramatic writer of conspicuous genius. See:

ENGLISH:

Udall
Norton
Sackville
Kyd
Lodge
Peele
Marston
Greene
Marlowe
Shakespeare
Nash
Dekker
Middleton
Jonson
Massinger
Beaumont and Fletcher
Ford
Webster
Davenant
Dryden
Wycherley
Otway
Congreve
Farquhar
Goldsmith

Sheridan
 Knowles, J. S.
 Beddoes, T. L.
 Taylor, Tom
 Robertson, T. W.
 Sims, G. R.
 Boucicault
 Pinero
 Jones, H. A.
 Shaw, George Bernard
 Phillips, Stephen
 Barrie, J. M.
 Galsworthy, John
 Synge, J. M.
 Masefield, John

AMERICAN:

Dunlap, William
 Payne, John Howard
 Brougham, John
 Boker
 Sargent, Epes
 Carleton, Henry Guy
 Howard, Bronson
 Campbell, Bartley
 Thompson, Denman
 Harrigan, Edward
 Belasco, David
 Fitch, William Clyde
 Moody, William Vaughan

A partial list of the more noteworthy actors, of all times and all nations, is as follows:

Anderson, Mary A.
 Archer, Belle
 Arnould, Sophie
 Arthur, Julia
 Bancroft, Mary E. W.
 Barrett, Wilson
 Barry, Elizabeth
 Barry, Spranger
 Bates, Blanche
 Bellamy, George Anne
 Bernhardt, Sarah

Betterton, Thomas
 Betty, W. H. W.
 Booth, Agnes
 Booth, Barton
 Booth, Edwin
 Booth, Junius Brutus
 Bracegirdle, Anne
 Burbage, Richard
 Campbell, Beatrice
 Clarke, J. S.
 Clive, Catherine
 Coghlan, Charles
 Coghlan, Rose
 Coquelin, B. C.
 Crane, W. H.
 Cushman, Charlotte
 Davenport, E. L.
 Davenport, Fanny
 Déjazet, P. V.
 Devrient, L.
 Drew
 Duse
 Farren, Elizabeth
 Fisher, Charles
 Fiske, Minnie M.
 Florence, W. J.
 Forbes-Robertson, J.
 Forrest, Edwin
 Garrick, David
 Gilbert, J. G.
 Gillette, W. H.
 Goodwin, N. C.
 Haase, F.
 Hackett, James H.
 Hading, Jane
 Hare, John
 Haworth, Joseph
 Herne, James A.
 Irving, Henry
 Janauschek, Fanny
 Jordan, Dorothy
 Kean, Edmund
 Kean, C. J.
 Kemble, Chas.

Kemble, Frances Anne
 Kemble, John Philip
 Kendal, Mr.
 Kendal, Mrs.
 Lecouvreur, Adrienne
 Lemaître, A. L.
 McCullough, J. E.
 Macklin, Charles
 Macready, W. C.
 Mansfield, Richard
 Mathews, Charles
 Mathews, C. J.
 Modjeska, H.
 Morris, Clara
 Mounet-Sully
 Oldfield, Anne
 Payne, J. H.
 Placide, H.
 Rachel, Mlle.
 Rehan, Ada
 Réjane, Mme.
 Ristori, A.
 Robson, Stuart
 Roscius
 Russell, Sol Smith
 Salvini, A.
 Salvini, T.
 Siddons, Sarah
 Sonnenthal, A.
 Sothorn, E. H.
 Stoddart, J. H.
 Thompson, Denman
 Tree, Beerbohm
 Vestris, Mme.
 Wallack, J. L.
 Wallack, J. W.
 Willard, E. S.
 Woffington, Margaret
 Wyndham, Charles

4. THE NOVEL. The novel, at present the most flexible of literary forms, though of recent date in its present character, traces back to early and multiple sources. The beast tale,

common to all nations, the narrative of adventure, and the story of things supernatural, were the precursors of the novel. The love element becomes pronounced in the old Greek romances and assumes primary importance in the romances of the Middle Ages. The romance, it may be broadly put, passed into the novel, when the tale began to assume the character of a picture of contemporary life, a development to be assigned to the sixteenth century. See the article NOVEL.

The great monuments and figures of pre-modern story-telling are the following:

SANSKRIT:

Dandin
 Subandhu
 Bana

ARABIC:

Arabian Nights

GREEK AND ROMAN:

Heliodorus
 Ephesiaca
 Daphnis and Chloe
 Apuleius
 Apollonius of Tyre
 Petronius

In Mediæval times, the romance flourished, combining in itself elements of the epic, the beast fable, and the tale of adventure and of love. Materials were largely drawn from ancient history, and the stories gathered around great figures of antiquity and the early Middle Ages. See:

Romance
 Fabliaux
 Gesta Romanorum
 Alexander, Legend of
 Charlemagne Cycle of Romances

Chrestien de Troyes
 Wace
 Roman de la Rose
 Perceval
 Tristram
 Lancelot of the Lake
 Malory
 Grail, The Holy
 Merlin
 Chaucer
 Morte d'Arthur
 Euphues
 Amadis of Gaul

Romance lacked characterization and reality. With the appearance of tales embodying observation of real types and description of manners, the novel as it is to-day begins. The origin is generally placed in Spain, where the rise of the picaresque tale marks the first step in character delineation. The subsequent development is rapid to present conditions, when the novel has become the all embracing term for all prose fiction, realistic, romantic, adventurous, or didactic. See for the writers:

FRENCH:

Scudéry, Madeleine de
 Lafayette, Marie Madeleine de
 Scarron
 Lesage
 Voltaire
 Genlis, Countess de
 Prévost d'Exiles
 Saint-Pierre
 Stendhal
 Balzac
 Hugo
 Dumas, the Elder
 Sue
 Erckmann-Chatrian
 Kock, Paul de

Sand, George
 Merimée, P.
 Flaubert
 Goncourt
 Feuillet
 Daudet
 Loti, Pierre
 Zola
 Bourget
 Margueritte, P.
 Prévost, E. M.
 France, Anatole

ITALIAN:

Boccaccio
 Manzoni
 Amicis
 Fogazzaro, A.
 Verga, G.
 Annunzio, Gabriele d'
 Farina, S.
 Serao, Matilda

SPANISH:

Cervantes
 Aleman
 Valera y Alcalá Galiano
 Galdos
 Palacio Valdés
 Alarcón
 Pereda
 Pardo Bazán

GERMAN:

Goethe
 Fouqué
 Gutzkow
 Eichendorff
 Alexis, W.
 Hauff
 Laube
 Auerbach
 Reuter, Fritz
 Tieck, L.
 Freytag
 Storm, Theodor

Scheffel
Gerstäcker
Spielhagen
Anzengruber
Dahn
Heyse
Ebers
Frenssen

SWEDISH :

Rydberg
Bremer, Frederika
Strindberg

DANISH :

Blicher
Drachmann

NORWEGIAN :

Björnson
Lie
Kielland

HUNGARIAN :

Jókai
Eötvös

RUSSIAN :

Gontcharov
Pisemski
Gogol
Turgenev
Dostoyevsky
Tolstoy
Korolenko
Gorky
Chekhov

POLISH :

Kraszewski
Sienkiewicz
Orzeszkowa

Defoe began the line of great English novelists with what is still the greatest story of adventure in our literature. Fielding then perfected the form. Manners were acutely

studied by a succession of women writers, who bridged the eighteenth and nineteenth centuries. Barren practically of the drama, the latter century found expression in the novel to as fully great an extent as in lyric poetry. See:

ENGLISH :

Behn, Afra
Defoe
Sterne
Smollett
Fielding
Richardson
Inchbald, Elizabeth Simpson
Godwin
Burney, Frances
Radcliffe, Ann
Edgeworth, Maria
Scott
Austen, Jane
Porter, Jane
Peacock, Thomas Love
Lover, Samuel
Borrow
Lever, Charles
Bulwer-Lytton
Gaskell, Elizabeth
James, G. P. R.
Thackeray
Marryat, Frederick
Dickens
Reade
Trollope
Kingsley, Charles
Eliot, George
Brontë, (Charlotte, Emily, Anne)
Collins, Wilkie
Blackmore
Oliphant, Margaret
Meredith, George
Morris, William
Du Maurier
Black, William

Hardy, Thomas
 Stevenson, Robert Louis
 Russell, W. C.
 Ward, Mrs. Humphry
 Moore, George
 Hawkins, Anthony Hope
 Kipling, Rudyard
 Conrad, Joseph
 Gissing, George
 Hewlett, Maurice
 Quiller-Couch, A. T.
 Wells, H. G.
 Bennett, Arnold
 Galsworthy, John

The nineteenth century produced in America in the realm of fiction a master romancer, Cooper, two masters in their art, Hawthorne and Poe, and at least two talented exponents of modern realism, James and Howells. See:

Brown, Charles Brockden
 Cooper
 Poe
 Hawthorne
 Hale, E. E.
 Howells
 Harte, Bret
 James, Henry
 Cable, George Washington
 Fawcett, Edgar
 Grant, Robert
 Jackson, H. H.
 Melville, Herman
 Tourgee, A. W.
 Wilkins, Mary
 Allen, James Lane
 Page, Thomas Nelson
 Garland, Hamlin
 Stockton, Frank R.
 Norris, Frank
 Atherton, Gertrude
 Wharton, Edith

5. CRITICISM AND ESSAY.

1. The principles underlying artistic endeavor have been discussed since early Greek times, and may be divided into two classes, the universal laws of artistic expression, which have always been accepted, and the minor theories, more limited in scope and applying generally to individual arts, which never have been accepted by all, and never will be. Plato first studied in a thorough manner the relations of art to reality. Aristotle's *Poetics* laid down the principles that have undergone no essential change since his time. On the other hand, the blending of the classic spirit with the Teutonic, and the subsequent rise of chivalry and romance, produced differences of opinion regarding subject, scope, and manner that are in full force at the present day. See:

Criticism
 Realism and Naturalism
 Romanticism
 Impressionist School of Painting
 Décadents
 Symbolists

2. Criticism in the beginning found expression in both prose and verse; the modern tendency has been decidedly towards prose, though there is not wanting a Pope's *Essay on Criticism* to continue the succession from Horace's *Ars Poetica*. The usual form, then, in which criticism at present finds expression is the Essay. See: ESSAY, and for the writers:

GREEK:
 Plato
 Aristotle
 Plutarch
 Longinus

LATIN :

Cicero
 Horace
 Seneca the Elder
 Varro
 Pliny
 Quintilian

FRENCH :

Montaigne
 Saint-Evremond
 Corneille
 Boileau
 Voltaire
 Diderot
 Bayle
 Taine
 Cousin
 Lamartine
 Sainte-Beuve
 Michelet
 Sarcey
 France, Anatole
 Faguet, Émile
 Brunetière
 Lemaître, Jules
 Gourmont, Rémy de

ITALIAN :

Dante
 Boccaccio
 Poliziano
 Vida
 Scaliger, J. C.
 Carducci, Giosuè
 De Sanctis, F.
 Gubernatis, A.
 Croce, B.

GERMAN :

Reuchlin
 Winckelmann
 Gottsched
 Herder
 Lessing
 Schiller

Schlegel, Friedrich

Grimm

Scherer, W.

Menzel

Bahr, Hermann

Nordau, Max

DUTCH :

Erasmus

DANISH :

Rafn

Brandes

RUSSIAN :

Belinsky

Pisarev

ENGLISH :

Ascham

Sidney

Bacon, Francis

Dryden

Steele

Addison

Swift

Johnson

Pope

Jeffrey

Coleridge

Wordsworth

Lamb

Hazlitt

Wilson, John

De Quincey

Hunt, J. H. Leigh

Carlyle

Ruskin

Arnold, Matthew

Rossetti, W. M.

Stevenson, Robert Louis

Pater, W.

Symonds, J. A.

Saintsbury, George

Stephen, Leslie

Dowden, Edward

Archer, William

Gosse, Edmund
Shaw, G. B.

AMERICAN:

Irving
Emerson
Ticknor, G.
Lowell
Fuller, Sarah Margaret
Curtis, G. W.
Whipple
White, Richard Grant
Hutton, Laurence
Mabie, Hamilton
Woodberry, George Edward
Winter, William

6. MORALISTS, SATIRISTS, AND HUMORISTS.

The study of human character and conduct has at all times received the attention of great minds, and what may be called ethical literature forms a very important part of the literature of the world. Near to constructive moralists, like Epictetus or Carlyle, stands the satirist, whose mission it is to combat the evil of degenerate times. The contemplation of the petty faults and incongruities of human character and action, so portrayed as to arouse laughter without arousing deep emotion of any kind, has always been a universal source of amusement. See:

GREEK AND ROMAN:

Aristophanes
Lucian
Epictetus
Ennius
Lucilius
Horace
Juvenal
Martial
Persius
Lucan

Tacitus
Petronius
Aurelius, Marcus

FRENCH:

Rabelais
Ménippée
La Bruyère
La Rochefoucauld
Pascal
Lesage
Voltaire
Chamfort, S. R.
France, Anatole

ITALIAN:

Jacopone da Todi
Aretino

SPANISH:

Quevedo y Villegas

GERMAN:

Fischart, Johannes
Brant
Hutten, Ulrich von
Epistolæ Obscurorum Virorum
Grimmelshausen
Rabener
Lichtenberg
Wieland
Tieck
Richter, Johann Paul
Reuter, Fritz

DUTCH:

Erasmus
Marnix

RUSSIAN:

Kantemir
Shtchedrin
Nekrasov

ENGLISH:

Langland (Piers Plowman)
Skelton
Bunyan
Butler

Dryden
Pope
Swift
Junius, Letters of
Arbuthnot
Byron
Carlyle
Smith, Sydney
Thackeray
Dickens
Calverley
Gilbert, W. S.
Mallock, W. H.
Lear, Edward
Jerome, Jerome K.
Shaw, G. B.

SCOTCH:

Dunbar
Barclay

AMERICAN:

Ward, Nathaniel
Franklin
Irving
Lowell
Holmes
Smith, Seba
Clemens, S.
Leland, C. G.
Locke, D. R.
Browne, C. F.
Bunner, H. C.
Shaw, H. W.
Stockton, F. R.
Nye, E. W.
Dunne, Finley Peter

7. ORATORY.

The art of eloquent persuasion is found among all primitive peoples where social bonds have become of some importance. Oratory attains its fullest development in the Greek democracies, where the citizen was called upon to take so considerable a share in the

public life. The political and juristic genius of the Roman was likewise favorable to the development of the art. Pulpit eloquence had some of its greatest masters among the early Fathers of the Church, which has never been wanting in masterly exponents of its doctrines. A great period in the history of oratory was the age of the French Revolution, when, contemporaneously in England too, a succession of great orators lent lustre to the reign of George III. In the United States, the revolutionary period, and the period of rapid national growth, produced a brilliant series of orators, culminating in the classic triad, Clay, Webster, and Calhoun. At present oratory may be considered a declining art, especially as related to secular affairs; and, though its power over the multitude may still be felt in electoral campaigns, its influence in legislative bodies has largely passed away. See ORATORY; and, for the great orators of all ages:

GREEK:

Pericles
Gorgias
Isocrates
Lysias
Andocides
Isæus
Æschines
Demosthenes
Athenasius
Chrysostom
Basil the Great

ROMAN:

Cato of Utica
Hortensius
Cicero
Ambrose

FRENCH:

Bossuet
 Bourdaloue
 Massillon
 Fénelon
 Mirabeau
 Barnave
 Vergniaud
 Guadet
 Danton
 Robespierre
 Royer-Collard
 Lamartine
 Lacordaire
 Thiers
 Gambetta
 Jaurès, J. L.

ITALIAN:

Mazzini

SPANISH:

Castelar

HUNGARIAN:

Kossuth

ENGLISH:

Taylor, Jeremy
 Baxter, Richard
 Whitefield
 Mansfield
 Burke
 Pitt, the Elder
 Pitt, the Younger
 Fox, C. J.
 Sheridan, R. B.
 Erskine, Lord
 Canning
 Bright, John
 Gladstone
 Drummond, Henry
 Spurgeon, C. H.

IRISH:

Curran
 Grattan

O'Connell

Emmet

AMERICAN:

Otis, James
 Henry, Patrick
 Lee, Richard Henry
 Ames, Fisher
 Channing, W. E.
 Randolph, John
 Wirt, William
 Benton
 Clay
 Webster
 Calhoun
 Hayne
 Everett
 Choate, Rufus
 Seward, W. H.
 Sumner, Charles
 Stephens, Alexander
 Beecher, H. W.
 Douglas, Stephen A.
 Evarts, W. M.
 Edmunds, George
 Conkling, Roscoe
 Ingersoll, Robert
 Brooks, Phillips
 Bryan, William Jennings
 Choate, Joseph H.

8. THE FABLE.

Probably it was the inhabitants of India who first ascribed human wisdom and language to animals. From India the fable passed westward, and, beginning with the Greek Æsop, we find practically the same scheme and contents in all European fabulists. See:

INDIA:

Pancatantra
 Bidpai

ARABIAN:

Lokman

GREEK :

Æsop

LATIN :

Phædrus

FRENCH :

Marot

La Fontaine

Perrault

Florian

Laboulaye

RUSSIAN :

Krylov

GERMAN :

Hagedorn

Gellert

Lessing

Grimm

NORWEGIAN :

Asbjørnsen

Moe

DANISH :

Andersen

ENGLISH :

Gay

9. PERSONAL LITERATURE.

This name may be applied to such productions as diaries, memoirs, letters, and "confessions" of distinguished men and women, or men and women whose experiences in life have been extraordinary. Written, it may be presumed, for the purpose of self-expression, they are valuable indexes of character, motives, and causes. See:

Letters in Literature

Aurelius, Marcus: Meditations

Augustine: Confessions

Sévigné, Marquise de

Saint-Simon: Mémoires

Rousseau: Confessions

Senancour: Obermann

Amiel

Selden: Table Talk

Pepys

Evelyn

Walpole, Horace

Chesterfield

10. JOURNALISM.

The press, which must be regarded as an important element in the literary life of any nation, may be studied under the following heads:

Periodical Literature

Journalism, College

Newspaper

Punch

Figaro

Times, The

Printing

A partial list of noteworthy names in journalism is as follows:

About, Edmond

Blowitz, Henri Georges

Bonner, Robert

Bowles, Samuel

Creelman, James

Curtis, W. E.

Dana, C. A.

Forbes, Archibald

Godkin, E. L.

Greeley, Horace

Halstead, Murat

Harden, Maximilian

Kennan, George

Labouchère, Henry

Lemon, Mark

Norman, Henry

Northcliffe, Lord

Pulitzer, Joseph

Raymond, H. J.

Reid, Whitelaw

Rochefort, Henri

Russell, W. H.

Sala, G. A. H.

Smalley, G. W.
Stanley, H. M.
Stead, W. T.
Steevens, G. W.
Taylor, Bayard
Traill, H. D.
Villiers, F.
Watterson, Henry
Weed, Thurlow
White, Horace
Wilkinson, H. S.
Young, J. R.

11. MISCELLANEOUS TITLES.

Manuscript
Manuscripts, Illumination of

Papyrus
Palimpsest
Paleography
Codex
Coster
Gutenberg
Fust
Elzevir
Manutius
Foulis
Encyclopædia
Dictionary
Larousse
Brockhaus
Copyright
Literary Property

Chapter 10. The Fine Arts

(Architecture)

THE study of the fine arts may be approached from one of three different points of view. The first of these is the historical, in which the student desires to obtain a comprehensive view of the art of a nation or of an entire period, its general characteristics and development. Another is the artistic, in which knowledge of a particular art or of some of its aspects is desired. A third is the biographical, in which the interest centres about an individual artist. To meet the first point of view, the *New International Encyclopædia* contains general articles treating the architecture, sculpture, painting, and minor arts of certain nations and periods. These general articles may best be divided into two groups: those treating the art of Oriental nations, whose artistic development is remotely or not at all concerned with the general European evolution; and those dealing with the great periods of artistic development participated in by the Occident in general. This division obviates the necessity for general articles on the art of separate European countries, as, for instance, French art, which will be found treated under ROMANESQUE, GOTHIC, and RENAISSANCE ART, and in the general articles ARCHITECTURE, SCULPTURE, PAINTING. The artist's point of view is represented by general articles on Painting, Sculpture, and Architecture, and by articles on the various schools, and on technical terms and processes. The biographical side is fully dealt with in the lives of all the principal artists. The art museums are usually described under the titles of the cities in which they are situated; but a few are of sufficient importance to require separate articles. The principal schools of design are described in the general article upon that subject and in special articles on the more important schools. The description of celebrated representations in painting and sculpture is usually given in the biography of the artist who produced them. The article MYTHOLOGY IN ART gives a general treatment of such representations in Classic Art, which are further treated under the names of the subjects represented, as JUPITER, HERCULES, ACHILLES. The article ICONOGRAPHY similarly treats Christian Art, and there are special articles on a number of important themes of artistic treatment, such as CHRIST IN ART and MADONNA.

A. General Articles

I. INTRODUCTORY:

Art
Art, Primitive
Æsthetics

II. ORIENTAL ART:

Egyptian Art
Babylonian Art

Assyrian Art
Jewish Art
Phœnician Art
Mohammedan Art
Persian Art
Indian Art
Chinese Art
Japanese Art

III. EUROPEAN DEVELOPMENT:

Greek Art
Etruria
Roman Art
Christian Art
Byzantine Art
Monastic Art
Romanesque Art
Lombard Art
Gothic Art
Renaissance Art

IV. ART MUSEUMS, SOCIETIES, AND SCHOOLS:

Design, Schools of
École des Beaux-Arts
National Academy of Design
Society of American Artists
Royal Academy of Arts
Saint Luke, Academy of
British Museum
Louvre
Luxembourg Palace
Pitti Palace
Uffizi

B. Architecture

In its widest sense, Architecture includes any kind of construction; but, in the *New International Encyclopædia*, the term is usually restricted to building which attains the dignity of art. Purely technical and utilitarian phases of architecture are treated under BUILDING, FIREPROOF CONSTRUCTION, MASONRY, and similar titles. (See the chapter on Manufactures and Engineering.) The three principal varieties of architecture are civil, religious, and military; and under these heads will be found their chief subdivisions. A few of these call for more detailed treatment of the component parts, and these are best enumerated below in connection with that style under which they were principally developed; as, for instance, TEMPLE under Greek Architecture, CHURCH under Early Christian, MONASTERY and CASTLE under Romanesque. Most celebrated works of architecture are treated in the articles on those cities in which they are situated; but a number of buildings of especial interest are

treated separately, and in the following scheme of study, such buildings are enumerated under the different styles of architecture of which they are representative. For example, PARTHENON, ERECHTHEUM, etc., appear under Greek Architecture, NOTRE DAME DE PARIS and WESTMINSTER ABBEY under Gothic.

I. CIVIL ARCHITECTURE:

Municipal Architecture
Forum
Palace
Fountain
Villa
Mausoleum
Theatre
Amphitheatre
Circus
Bath
Town Hall
Arch, Triumphal
Aqueduct
Bridge

II. RELIGIOUS ARCHITECTURE:

Temple

Church
Cathedral
Monastery
Oratory
Baptistery

III. MILITARY ARCHITECTURE:

Acropolis
Citadel
Castle
Camp
Fortification

IV. TECHNICAL TERMS.

A large number of architectural terms deserve special treatment. Some of these, which are general in their application, are enumerated below, while others, the application of which is restricted to a particular style, are enumerated under that style; as, for example, **MOSQUE** under Mohammedan. See:

Arabesque
Arcade
Arch
Balcony
Balustrade
Bay Window
Belfry
Ceiling
Colonnade
Column
Cupola
Dome
Door
Doorway
Façade
Floor
Hall
Molding
Orders of Architecture
Ornament
Panel

Pendentive
Pilaster
Pillar
Porch
Portal
Roof
Spire
Tower
Tracery
Window

V. HISTORIC STYLES AND BIOGRAPHY.

Architecture is the most ancient and, perhaps, the most important of the fine arts. In most artistic developments, both painting and sculpture have been subordinate to it. Its historical treatment, therefore, forms an extensive and important part of the general department of architecture in the *Encyclopædia*. A general historical sketch of its development, from the most ancient times to the present, is given in the article **ARCHITECTURE**. This should be supplemented by the copious articles on the great historic styles, with the biographical additions given in the following list. Our treatment will outline the salient features of the different styles, beginning with those Oriental nations whose architecture lies remote from the European development—such as China, India, and Japan. We then proceed to those ancient nations, like Babylonia and Egypt, which materially influenced the Greek architecture. From Greek architecture, is descended the Roman, and from the Roman, the Mediæval and Renaissance styles, and finally the architecture of the present day.

1. *India.*

The architecture of India begins with the Buddhist style (B. C. 300-A. D.

700), whose buildings are of three classes: stupa or tope (a mound enclosing a relic); rock temples (chaityas); and monasteries (viharas). The Neo-Brahmanic style (beginning A. D. 700) comprises many varieties, including the so-called Jaina and Dravidian. It developed the architectural detail, the over-rich ornamentation, the pagodas and gopuras of the South. The Mohammedan architecture of India, differing materially from these styles, is best treated under MOHAMMEDAN ART. See:

Indian Art
Tope
Vihāra
Ellora
Vijayanagara
Boro Buddor
Elephanta
Mohammedan Art

2. *China and Japan.*

The most characteristic feature of Chinese architecture, which begins in the first century B. C., after the advent of Buddhism, is the tiled roof of tent-like form. Others are the pagoda, the pail-loo (a monumental gateway), and elaborately colored surface decoration. Japanese architecture, which begins with the seventh century A. D., is even less massive. It makes more of timber construction, and spends more upon roof effects than the Chinese. See:

Chinese Art
Japanese Art
Pagoda

3. *Babylonia and Assyria.*

The earliest dated architectural remains are those of the Babylonians, from as far back as B. C. 6000. Their build-

ing material was brick, and they were the first to construct vaults and arches. Their most important buildings were the temples, which were stepped pyramids of great height, brilliantly colored with glazed tiles. Their city walls were of amazing height and thickness.

Assyrian architecture was derived from the Babylonian, but was more secular in character, the chief buildings being the royal palaces, in which it perfected decorative relief sculpture of a high order. See:

- (a) Babylonian Art
Babylon
Babel, Tower of
Nippur
Erech
Ur
- (b) Assyrian Art
Nineveh
Nimrud
Khorsabad
Koyunjik

4. *Persia, Phœnicia, Judea.*

The Babylonian-Assyrian influence was determinative for the architecture of the Hittites, and for the utilitarian art of the Phœnicians, who built for Solomon the Temple at Jerusalem. Ancient Persian architecture shows a mingling of Babylonian with Egyptian and Greek influences; but, under the Parthian and Sassanian dynasties, it reverted to purer Oriental types. See:

Hittites
Phœnician Art
Jewish Art
Temple at Jerusalem
Persian Art
Ecbatana
Susa

Pasargadæ
Firuzabad

5. *Egypt.*

The architectural monuments of the Old Empire (B. C. 4500-2160) are chiefly sepulchral—pyramids, mastabas, and tomb-temples. Temple architecture took on a new development with the Middle Empire (B. C. 2160-1788), and attained its highest development under the New Empire (B. C. 1588-1150), which followed the disastrous interruption of the Hyksos invasion. After a long decline, there was a brilliant revival under the Ptolemies in the third century B. C. The temples were often, like the Ramesseum, sepulchral; some were rock-cut, as at Abu-Simbel; some partly hewn and partly constructed, as at Deir-el-Bahri. The greatest temples are those of Karnak, Luxor, Medinet-Habu, Abydos, the Ramesseum, and the Ptolemæ and Roman temples of Denderah, Philæ, and Edfu. For descriptions, consult the section *Architecture*, under EGYPTIAN ART. See:

Egyptian Art
Pyramid
Mastaba
Mêdûm
Luxor
Thebes
Karnak
Edfu
Elephantine
Abu-Simbel
Deir-el-Bahri
Ramesseum
Medinet Habu
Denderah
Philæ
Beni-Hassan

6. *Greece.*

The Mycenæan architecture in Greek lands, sometimes known as the Ægean style, is described under ARCHÆOLOGY, and in the articles on the principal sites of this culture. From the main hall of the Mycenæan palace was evolved that marvelous structural masterpiece, the Greek Temple, the final type of which appears in the seventh century B. C. For a description of this temple, which is the central figure of Greek architecture, consult GREEK ART. The origin and development of the two principal styles of temple architecture, Doric and Ionic, are treated under ARCHITECTURE and ARCHÆOLOGY. The earliest examples of the Doric are in Sicily and Southern Italy, and it attained perfection during the fifth century, in buildings like the Parthenon and Theseum at Athens, and in the temples of Pæstum. The Ionic order was increasingly used in the fourth century B. C., as at Miletus and Ephesus, the Corinthian being as yet used for small monuments only. The Hellenistic age saw a great development of architecture of a private, civil, and sepulchral character, like the stoa, propylæa, theatre, odeon, and mausoleum.

(a) General Titles:

Cyclopean Architecture
Archæology
Greek Art
Temple
Doric Order
Ionic Order
Corinthian Order
Column
Fluting
Entablature
Base

Pediment
Frieze
Cornice
Acanthus
Pæstum
Agrigentum
Selinus
Segesta
Parthenon
Theseum
Erectheum
Phigalia
Miletus
Diana, Temple of
Teos
Magnesia

(b) Civil Architecture:

Propylæa
Stoa
Colonnade
Stadium
Theatre
Mausoleum
Choragic Monument

(c) Biography:

Ictinus
Callicrates
Mnesicles

7. *Rome.*

For a general view of Roman architecture, the student is referred to **ROMAN ART**. The early architecture of Rome is practically Etruscan, and to this people the Romans owe their knowledge of vaulting and the arch. At the close of the republican epoch, they adopted Greek orders, evincing special preference for the Corinthian, which they developed into an independent order, and from which they evolved the so-called composite. These forms were decoratively used as adjuncts of con-

struction. The principal works of Roman architecture were great civil structures, like the fora, triumphal arches, amphitheatres, thermæ, aqueducts, besides many superb temples. The highest development was during the first 150 years of the empire, after which came the decline. See:

(a) Etruria (section on Art)

Cloaca
Roman Art
Aqueduct
Tabularium
Forum
Trajan, Forum of
Basilica
Pantheon
Theatre
Amphitheatre
Arch, Triumphal
Trajan, Arch of
Titus, Arch of
Constantine, Arch of
Septimius Severus, Arch of
Antonine Column
Caracalla, Baths of
Diocletian, Baths of
Tivoli
Pompeii
Herculaneum
Baalbek
Palmyra

(b) Biography:

Apollodorus

8. *Early Christian.*

Early Christian architecture is an adaptation of the declining Roman to the needs of Christian worship. The requirement was a large interior for many worshippers, resulting in the development of the basilical construction, which became typical for church build-

ing. The component parts of the basilica are discussed in the articles listed below under **Basilical Construction**. The article **CHURCH** gives the general development of the church building. To this is added a list of other terms of ecclesiastical architecture.

(a) **Basilical Construction:**

Basilica
Apse
Transept
Atrium
Nave
Altar
Choir
Confessional

(b) **Church, etc.:**

Church
Catacombs
Chancel
Chapel
Crypt
Font
Reredos
Sacristy

9. *Byzantine.*

In the eastern half of the Roman Empire, the Byzantines developed the domical construction, inventing the pendentives to support the dome. Byzantine architecture was also characterized by rich mosaic decoration. Its great masterpieces are the Church of Saint Sophia at Constantinople and Saint Mark's at Venice. It prevailed throughout the Eastern Empire until its destruction by the Turks; in Southern Italy, Sicily, Venice, and Ravenna; in Armenia, the Balkans, and wherever else the Greek Church prevailed. Russian architecture is a development of the Byzantine. See:

Byzantine Art

Mosaic

Dome

Pendentive

Saint Sophia

Saint Mark's Church

Anthemius (of Tralles)

10. *Mohammedan.*

Coincident with the Mohammedan conquests, a style of architecture arose based upon the Byzantine and Persian. Its golden age began with the tenth century, and the final types were attained in the eleventh. The ultimate type of the mosque was built on the court-plan, with pointed arches, highly colored geometrical ornament, and dome vaulting. The principal schools were the Moorish (Spain), Egyptian, Turkish, Persian, and the Mohammedan styles that grew up in India. All these are described in **MOHAMMEDAN ART**, besides which there are articles upon the most prominent features of Mohammedan architecture. See:

Mohammedan Art

Mosque

Minaret

Tekiyé

Bazar

Caravanserai

Alhambra

Taj Mahal

11. *Romanesque* (A. D. 800-1200).

In Middle and Western Europe, Early Christian architecture was succeeded by the Romanesque, which was pre-eminently the art of the monastic orders and of feudalism. Among its innovations were the cruciform plan, the developed crypt, and the incorporation of bell-towers with the church building. But the principal achieve-

ment of Romanesque architecture was the perfection of vaulting,—the dome and tunnel vault in Southern France, and the groined vault in Lombardy, the Rhinelands, Normandy, and England. It thus led the way to the development of the pointed arch and Gothic architecture. The basis of the study of Romanesque architecture should be the appropriate section of **ROMANESQUE ART**. See:

Romanesque Art
Lombard Art
Norman Architecture
Vault
Crypt
Bell-Tower
Castle
Keep
Bailey
Tower
Bastion
Barbican
Wartburg
Monastery
Cloister
Chapter-house
Dormitory

12. *Gothic*.

Gothic architecture is the development of Romanesque groined vaulting. By means of the pointed arch, the most characteristic feature of the system, the vertical strains are concentrated in powerful piers, the horizontal thrusts on flying buttresses, permitting light walls, huge windows and an infinite wealth of statuary and tracery. Gothic architecture originated in France in the twelfth century, and there it also attained its most perfect development in the thirteenth, declining into the Flamboyant style of the fifteenth century.

Spanish Gothic of the thirteenth century is second only to the French, though later debased by too much ornament. In England, a peculiarly national style arose, which should be studied under the headings by which three varieties are usually known, **EARLY ENGLISH**, **DECORATED**, and **PERPENDICULAR**. At its best, the German Gothic is noted for its beautiful tracery and spires. In Italy, the Gothic style is purely decorative, and it produced a charming style of civic buildings, especially in Tuscany and Venice. The basis of study should be the article, **GOTHIC ARCHITECTURE**, supplemented by the articles on special churches, and the descriptions in the articles on the cities, a few of which are appended. See:

(a) Gothic Architecture

Vault
Flamboyant
Early English
Decorated Style
Perpendicular
Fan-Tracery Vaulting
Notre Dame de Paris
Sainte Chapelle
Westminster Abbey
Santa Croce

(b) Cathedral Cities:

Rheims
Amiens
Burgos
Lincoln
Salisbury
York
Canterbury
Winchester
Cologne
Strassburg
Nuremberg

Freiburg
Milan
Florence
Siena
Orvieto

(c) Biography:

Montreuil, Pierre de
William of Wykeham
Erwin
Arnolfo di Cambio

13. *Renaissance.*

(a) Italy.

Renaissance architecture is the adaptation of classical forms, as they survived in Roman remains, to the architectural needs of the day. The Early Renaissance (fifteenth century) originated in the works of Brunelleschi at Florence, whence it was introduced into the rest of Italy. Its work was decorative in character, the constructive side being rather developed by the Roman school, headed by Bramante. The tendency was increasingly towards the formal classicism evinced in the works of Palladio and Vignola. As a reaction, came the freer but exaggerated Barocco of the seventeenth and eighteenth centuries. The basis of study should be the section *Architecture*, under RENAISSANCE ART.

(i) Prominent Buildings:

Certosa
Doge's Palace
Pitti Palace
Lante, Villa
Villa, Giulia
Saint Peter's Church

(ii) Biography:

Brunelleschi, Filippo
Michelozzi, Michelozzo

Alberti, Leone Battista
Giuliano da Majano
Laurana, Luciano da
Sangallo
Bramante, Donato d'Agnolo
Peruzzi, Baldassare
Sansovino, Jacopo
Michelangelo
Vignola, Giacomo Barozzo da
Palladio, Andrea
Serlio, Sebastiano
Scamozzi, Vincenzo
Fontana, Domenico
Maderna, Carlo
Bernini, Giovanni Lorenzo
Borromini, Francesco
Ammanati, Bartolommeo
Longhena, Baldassare

(b) Other Countries.

Outside of Italy, the most important development of Renaissance architecture was the French. Its most original type was the mediæval castle transformed into the palace of the Renaissance. There was constant influence from Italy, but the later French Barocco is superior to the Italian. In Germany, the Gothic elements survived late, and materially influenced the incoming Renaissance. A similar development occurred in other European countries. Spain made use of much elaborate decorative detail. The Renaissance appeared latest of all in England in the seventeenth century. A kind of Palladian High Renaissance, adopted by Inigo Jones, and developed by Wren, retained a purifying influence during the eighteenth century, until the advent of classic revival.

(i) France:

Palace
Chambiges, Martin

Bullant, Jean
 De l'Orme, Philibert
 Lescot, Pierre
 Brosse, Salomon de
 Mansart
 Fontainebleau
 Louvre
 Tuileries
 Luxembourg Palace

(ii) Great Britain:

Jones, Inigo
 Wren, Sir Christopher
 Van Brugh, Sir John
 Hawksmoor, Nicholas
 Chambers, Sir William
 Nash, Sir John
 Dance, George
 Saint Paul's Cathedral
 Whitehall

14. *Nineteenth Century.*

The reaction against the exaggerated styles of the eighteenth century was an imitation of classical forms. In France, Roman forms were predominant in the great structures of the Republic and first Empire; but, in England and Germany, Greek forms were more closely followed. About 1830 came the Gothic revival, which attained especial development in England, in such buildings as the Houses of Parliament and numberless churches. The present tendency is towards Renaissance forms and greater freedom from tradition.

The tasteful colonial architecture of the United States followed English models, but the early republic adopted the classic revival (Capitol). The period of the Civil War (till 1870) was singularly unfruitful; but between 1870 and 1880 there was a revival of the artistic spirit. The problem of

the artistic treatment of the skyscraper with the steel-frame construction is as yet unsolved; but constant improvement is being made. The basis of study should be the section on the *Nineteenth Century*.

(a) France:

Soufflot, Jacques Germain
 Percier, Charles
 Fontaine, P. F. L.
 Viollet-le-Duc
 Visconti, L. T. J.
 Garnier, J. L. C.

(b) Germany and Austria:

Gärtner, Friedrich von
 Schinkel, Karl Friedrich
 Klenze, Leo von
 Hansen, Theophilus von
 Semper, Gottfried

(c) Great Britain:

Soane, Sir John
 Smirke, Sir Robert
 Pugin, Augustus
 Pugin, Augustus N. M.
 Wyatt, Sir Matthew D.
 Fergusson, James
 Scott, Sir George Gilbert
 Street, George Edmund
 Barry, Sir Charles
 Waterhouse, Alfred
 Paxton, Sir Joseph
 Parliament, Houses of

(d) United States:

Latrobe, Benjamin Henry
 Bulfinch, Charles
 Walter, Thomas Ustick
 Renwick, James
 Upjohn, Richard
 Hunt, Richard Morris
 Richardson, H. H.
 McKim, Charles F.

Chapter 11. The Fine Arts

(Sculpture and Painting)

(Read general introduction at the opening of preceding chapter.)

A. Sculpture

The study of sculpture centres about the general article on that subject. In this article will be found sections on the technical processes and materials, especially the modern, and on the different forms of sculpture, and a sketch of the history of sculpture, containing a description of the characteristics and the development of the different schools, as revealed in their principal artists. The study of the technical forms and processes of sculpture should be supplemented by the special articles enumerated below, which also contain historical sketches of these subjects; that of the history by those on the different schools and epochs of art, and above all by the biographies of the artists, some of which are enumerated below.

I. BRANCHES AND TECHNIQUE OF SCULPTURE.

- Carving
- Chasing
- Founding
- Relief Sculpture
- Equestrian Statue
- Bronze
- Chryselephantine
- Goldsmith's Work
- Terra Cotta
- Ivory
- Metal Work
- Wood-carving
- Stucco

II. GREEK AND ROMAN SCULPTURE.

The sculpture of Oriental countries

is decorative in character, and therefore best considered in connection with their architecture, under the titles of the division Oriental Art, enumerated in Chapter 9, Section A. Among the Greeks, sculpture first attained the dignity of an independent art, and achieved the highest ideal perfection in the world's history. The study of the separate epochs of Greek sculpture should be based upon the articles ARCHÆOLOGY and GREEK ART. Its rude beginnings date from the seventh century B. C., and by the end of the archaic period (B. C. 480) the emancipation was well advanced. The Attic period (480-323), during which the chief art centre was at Athens, witnessed the highest development of Greek art. It is ushered in by a period of transition (till about 450), in which great progress was made towards mastery of technique. The last half of the fifth century, the age of Phidias, begins the golden period of Greek art. The greatest technical knowledge was subordinated to idealism and self-restraint, and to the utmost nobility of conception. The golden age continued during the epoch of Praxiteles and Scopas, which, though still ideal, was more realistic and interested in individual traits and features. It succeeded especially well in portraiture, and attained the highest mastery of technique. During the Hellenistic age (323-146), the centres of art passed from Greece to Asia and Egypt, to

Pergamus, Rhodes, and Alexandria. Art came more into the service of individuals, and, notwithstanding the highest technical skill, it often sought sensational or trivial subjects. Roman sculpture is, for the most part, copied from the Greek, and shows little originality except in a fine realistic rendition of portraiture, and in pictorial relief-sculpture. See:

1. *The Archaic Period:*
 - Archæology
 - Greek Art
 - Antenor
2. *The Attic Period:*
 - Æginetan Sculptures
 - Calamis
 - Pythagoras of Rhegium
 - Myron
 - Discobolus
 - Phidias
 - Elgin Marbles
 - Polyclitus
 - Agoracritus
 - Cresilas
 - Pæonius
 - Cephisodotus
 - Praxiteles
 - Demetrius
 - Scopas
 - Mausoleum
 - Marsyas
3. *The Hellenistic Period:*
 - Lysippus
 - Pergamon
 - Zeus Atricoli
 - Apollo Belvedere
 - Venus of Milo
 - Laocoön
4. *The Roman Sculpture:*
 - Section *Sculpture* under Roman Art
 - Venus of Medici

III. MEDIEVAL SCULPTURE.

The decorative sculpture of the Middle Ages can best be studied in connection with the architecture of the period, under the titles of the mediæval epochs enumerated in Chapter 9, Section A. The history of modern sculpture begins with the Italian revival of the thirteenth century. Nicola Pisano found his models in the antique, but his son Giovanni reverted to the Gothic, and his naturalistic, dramatic style prevailed in Italy. The Pisan School was the mother of those of Florence and Siena. The former was superior in technique and composition, the latter was rather picturesque and narrative in character. During the entire Middle Ages, and to some extent during the Renaissance, the usages of Church worship furnished abundant opportunity for the sculptor's art. See:

1. *First Revival in Italy* (under Sculpture)
 - Christian Art
 - Byzantine Art
 - Romanesque Art
 - Gothic Art
 - Antelami, Benedetto
 - Pisano, Nicola
 - Pisano, Giovanni
 - Pisano, Andrea
 - Arnolfo di Cambio
 - Andrea di Ugo
 - Orcagna, Andrea
2. *Ecclesiastical Sculpture:*
 - Altar
 - Pulpit
 - Ambo
 - Cross
 - Crucifix
 - Reliquary

Chalice
Tomb

IV. THE RENAISSANCE.

The sources of inspiration during the Renaissance were the study of nature and of the antique, as it survived in ancient statues. The chief characteristic of the Early Renaissance is a healthy naturalism. It attained a high perfection, in relief as in statuary, and excelled equally in bronze, marble, and terra cotta. The centre of the art was Florence, and the dominant figure during the fifteenth century, amid a brilliant array of artists, was Donatello. The school of Siena was more sentimental in feeling and elaborate in decoration; those of Lombardy and Venice were luxuriant in decoration, the former being more vigorous in form. The High Renaissance is characterized by a deeper knowledge and greater influence of the antique and by a more universal style, notably in works of its greatest master, Michelangelo; but these qualities afterward degenerated into a mannered imitation, and later into the extravagances of the Baroque.

The sculpture of France in the fifteenth century was at first influenced by that of Flanders, but the native style soon became transformed by Italian grace and beauty. Even the Baroque of the seventeenth century here exhibits a certain classical restraint. During the eighteenth exaggerated form gave place to the more delicate and decorative treatment of the Rococo, which excelled especially in statuettes. A fine, healthy realism ultimately prevailed. In Germany, Gothic forms lingered throughout the

fifteenth century, and when, during the sixteenth, the Italian influence arrived, it was less important than in other countries and confined to the South. A native naturalistic art dominated the Netherlands during the fifteenth century, but, in the seventeenth, the Italian Baroque entered, and, in the eighteenth, sculpture declined. A similar development occurred in Spain, where wood sculpture found great employment in altars, retables, reredoses. Its apogee was a realistic reaction in the seventeenth century, with centre at Seville. See Section *The Renaissance*, under SCULPTURE.

1. *Italy:*

(a) Florence:

Ghiberti, Lorenzo
Donatello
Michelozzi
Robbia, Luca della
Verrocchio, Andrea del
Pollaiuolo, Antonio
Desiderio da Settignano
Rossellini
Benedetto da Maiano
Mino da Fiesole
Civitale, Matteo
Sansovino, Andrea
Michelangelo
Cellini, Benvenuto
Boulogne, Jean

(b) Other Cities:

Quercia, Jacopo della
Mazzoni, Guido
Solari, Cristoforo
Lombardi, Pietro
Leopardi, Alessandro
Sansovino, Jacopo
Leoni, Leone
Bernini, Giovanni Lorenzo
Algardi, Alessandro

2. *France:*

Colombe, Michel
 Goujon, Jean
 Pilon, Germain
 Puget, Pierre
 Coyzevox, Antoine
 Girardon, François
 Pajou, Augustin
 Pigalle, Jean Baptiste
 Falconnet, Etienne
 Michel, Claude (Clodion)
 Houdon, Jean Antoine

3. *Germany:*

Wohlgemuth, Michel
 Stoss, Veit
 Krafft, Adam
 Vischer, Peter
 Riemenschneider, Tilman
 Syrlin, Jörz
 Schlüter, Andreas
 Donner, Raphael

4. *Other European Countries:*

Sluter, Claus
 Duquesnoy, François
 Quellinus, Artus
 Berruguete, Alfonso
 Montañes, Martinez
 Cano, Alonzo
 Gibbons, Grinling

V. MODERN SCULPTURE.

The reaction upon the extravagances of Baroque sculpture, at the close of the eighteenth century, took the form of a return to classic simplicity, and the antique was imitated more closely than ever before. In France, this classicism was followed by a Romantic tendency, corresponding to a similar movement in painting, and by a more important naturalistic reaction. In the second half of the nineteenth

century, classicism and naturalism ran parallel, with an increasing influence of the latter, which now prevails. England had a similar classical period, and a subsequent transition to naturalism; but since 1870 a great change, both in conception and treatment, has come over English sculpture chiefly through the effort of great English painters and the French influence. The German reaction against classicism resulted in the historical school of Berlin, whose work tended toward naturalism, and in the romantic school of Munich; not until the end of the nineteenth century did naturalism prevail. In other European countries the development has been similar to that general evolution described above. After some ineffectual early attempts, America also had its classical school, with a number of important artists. Since the last quarter of the nineteenth century the tendency has been entirely naturalistic, and an array of talent has appeared which compares favorably with that of other countries. See:

1. *France:*

Pradier, James
 David d'Angers
 Rude, François
 Barye, Antoine Louis
 Chapu, Henri Michel
 Dubois, Paul
 Mercié, Antonin
 Barrias, Ernest
 Bartholdi, Frédéric
 Carpeaux, Jean Baptiste
 Frémiet, Emmanuel
 Dalou, Jules
 Rodin, Auguste
 Bartholomé, Paul Albert

2. England:

Flaxman, John
Westmacott, Richard
Gibson, John
Stevens, Alfred
Foley, John Henry
Woolner, Thomas
Watts, George Frederick
Thornycroft, Hamo
Brock, Sir Thomas
Ford, Edward Onslow
Gilbert, Alfred
Frampton, Sir George
Epstein, Jacob

3. Germany:

Dannecker, Johann Heinrich
Schadow, Johann Gottfried
Rauch, Christian
Hähnel, Ernst
Rietschel, Ernst
Schilling, Johannes
Schwanthaler, Ludwig
Begas, Reinhold
Stuck, Franz
Klinger, Max
Zumbusch, Kaspar
Tilgner, Viktor
Strasser, Arthur
Tuaille, Louis

4. Other European Countries:

Canova, Antonio
Thorvaldsen, Bertel
Tenerani, Pietro
Marchesi, Pompeo
Dupré, Giovanni
Ximenes, Ettore
Sergel, Johan Tobias
Sinding, Stefan
Antokolski, Mark
Troubetzkoi, Prince Paul

*5. United States:**(a) Classicists:*

Greenough, Horatio
Powers, Hiram
Crawford, Thomas
Story, William Wetmore
Rogers, Randolph
Rogers, John
Rinehart, William Henry
Hosmer, Harriet

(b) Early Naturalists:

Palmer, Erastus Dow
Mills, Clark
Ball, Thomas
Brown, Henry Kirke
Ward, J. Q. A.
Keyser, Ephraim

(c) Naturalism Under French Influence:

Warner, Olin Levi
Saint Gaudens, Augustus
French, Daniel Chester
Macmonnies, Frederick
Bitter, Karl
Niehaus, Charles Henry
Partridge, William Ordway
Dallin, Cyrus Edwin
Proctor, A. Phimister
Kemeys, Edward
Bartlett, Paul
Barnard, George Grey
Borglum, Gutzon
Borglum, Solon H.
Platt, Bela Lyon
Grafty, Charles
Calder, Alexander S.
Taft, Lorado
Tilden, Douglas
Aitkin, Robert I.
Vonnoh, Bessie Potter

B. Painting

A series of special articles treats the technical side of painting, the different varieties, the painter's implements, and the qualities by which a picture should be judged. The history of the different schools is comprehensively described under PAINTING. This article should form the basis of the study of any given school; it should, however, be supplemented by the articles on separate schools and the biographies of the artists, of which only the principal are contained in the following lists.

I. TECHNIQUE AND ALLIED ARTS.

1. *Varieties:*

- Mural Decoration
- Genre Painting
- Portraiture
- Landscape
- Still Life

2. *Technical Processes:*

- Fresco
- Tempera
- Oil Painting
- Pastel
- Water-Color Painting
- Encaustic Painting
- Stereochromy

3. *Implements:*

- Canvas
- Easel
- Mahlstick
- Ground
- Painters' Colors

4. *Technical Qualities:*

- Drawing
- Line
- Perspective
- Chiaroscuro

- Color
- Composition
- Proportion

5. *Analogous Arts:*

- Mosaic
- Stained Glass
- Decorative Art
- Sgraffito

II. GREEK PAINTING.

The decorative painting of Oriental countries is treated under the different titles of the subdivision Oriental Art, in the introductory section of the preceding chapter. Greek painting was the first to rise to the dignity of an independent art. The transition from the painting of Cretan and Mycenæan decorations, which show considerable technical skill and a high power of invention, to that of the fifth century B. C. can be studied only in vase-painting (see VASE). In the fifth and fourth centuries B. C., Greek painting attained its highest development. The older Attic School, with Polygnotus as its founder and Athens as a centre, brought the art to a high state of development in the years following the Persian wars. Its decorative work was practically great, colored, outline drawings, noble in composition and expression. Perspective and shading were discovered by Agatharchus of Samos, a scene painter, and applied to panel-painting by Apollodorus of Athens. In the later fifth century flourished the Ionian School of Zeuxis and Parrhasius, which substituted realism for the old idealism and excelled in delicate drawing and chiaroscuro.

In the early fourth century, the centre of painting shifted to Sicyon, where systematic drawing and chiaroscuro were further developed, and the process of encaustic painting was invented. The Theban-Attic School (second half of the fourth century) was devoted to impassioned subjects, like battle pieces, and even to genre, and the highest technical perfection was achieved by the younger Ionian School in the persons of Apelles and Protogenes. In the Hellenistic age painting increased the range of its expression, including even the landscape, but it declined in artistic quality. The decorative and less important painting of the Roman epoch is treated under **ROMAN ART**. See:

1. *General References:*

Section *Painting* under Greek
Art and Roman Art
Vase

2. *Greek Painters:*

Polygnotus
Micon
Agatharchus
Apollodorus
Zeuxis
Parrhasius
Pamphilus
Pausias
Apelles
Protogenes
Aldobrandini Marriage

III. **MEDIEVAL PERIOD.**

The origins of Mediæval painting were conditioned by the Mosaic style, as it prevailed in Early Christian and Byzantine art. Its growth was dependent upon the development of architecture in Church worship, and it con-

sequently remained decorative. At the close of the Gothic period, the emancipation of painting began in Italy, and individual artists arose. The chief centres were Florence, where Giotto founded a powerful school of mural painting, and Siena, which developed panel painting under strong Byzantine influence. See:

Mosaic
Christian Art
Byzantine Art
Romanesque Art
Gothic Art
Florentine School of Painting
Sienese School of Painting
Cavallini, Pietro
Cimabue
Giotto
Gaddi, Taddeo
Orcagna, Andrea
Aretino, Spinello
Duccio di Boninsegna
Martini, Simone
Lorenzetti
Gentile da Fabriano
Lorenzo, Don

IV. **THE RENAISSANCE.**

Naturalism dominated the painting of the Early Renaissance in Italy, the classic influence appearing only in the decorative motifs. Our study begins with Florence, where the great technical problems were solved for future painting. The High Renaissance combined the achievements of the Early with a profounder knowledge of the Antique. The Florentine school ranked highest in everything but color, in which the Venetians excelled, as did the Umbrians in religious sentiment. In Northern Europe the Renaissance, entirely naturalistic in character, but

Gothic in sentiment, first appeared in Flanders, whence its influence extended to Holland and Germany. Later the Italian influence transformed for the worse the art of the Netherlands, but aided to produce a national school in Germany. See:

1. *Italy.*

(a) General Titles:

Renaissance Art

Section *The Renaissance* under Painting

Florentine School of Painting

Umbrian School of Painting

Bolognese School of Painting

Ferrarese School of Painting

Venetian School of Painting

(b) Biography:

(i) Florence:

Masolino da Panicale

Angelico, Fra

Masaccio

Uccello, Paolo

Castagno, Andrea del

Lippi, Filippo and Filippino

Botticelli, Sandro

Gozzoli, Benozzo

Pollaiuolo, Antonio

Verrocchio, Andrea

Ghirlandaio, Domenico

Vinci, Leonardo da

Michelangelo

Bartolommeo, Fra

Sarto, Andrea del

Bronzino, Agnolo

(ii) Umbria:

Francesca, Piero della

Melozzo da Forlì

Santi, Giovanni

Signorelli, Luca

Perugino, Pietro

Pinturicchio

Raphael

(iii) Northern Italy:

Squarcione, Francesco

Mantegna, Andrea

Tura, Cosimo

Costa, Lorenzo

Francia, Francesco

Viti, Timoteo

Dosso Dossi

Garofalo

Correggio

Sodoma

Pisanello

Foppa, Vincenzo

Borgognone

Predis, Ambrogio da

Solario, Andrea

Luini, Bernardino

Ferrari, Gaudenzio

(iv) Venice:

Vivarini

Crivelli, Carlo

Antonello da Messina

Bellini (family)

Carpaccio, Vittore

Giorgione

Titian

Bonifazio Veronese

Lotto, Lorenzo

Tintoretto

Veronese, Paolo

Bassano

Moretto da Brescia

Moroni, Giambattista

(v) Rome:

Sebastiano del Piombo

Volterra, Daniele da

Pippi, Giulio (called Romano)

2. *The Netherlands:*

Netherlands Schools of Painting

Eyck, Huybrecht and Jan van

Weyden, Rogier van der

Bouts, Dierick

Hugo van der Goes
Memling, Hans
David, Gerard
Matsys, Quinten
Orley, Bernaert van
Mabuse, Jan
Lucas van Leyden
Bosch, Hieronymus

3. *Germany:*

Lochner, Stephan
Schongauer, Martin
Wohlgemuth, Michel
Dürer, Albrecht
Burckmair, Hans
Cranach, Lucas
Holbein the Elder
Holbein the Younger
Grünewald, Matthias
Baldung, Hans

4. *France and Spain:*

Fouquet, Jehan
Clouet
Cousin, Jean
Coello, Alonzo
Morales
Theotocopuli (called El Greco)

V. SEVENTEENTH AND EIGHTEENTH CENTURIES.

The seventeenth century saw the rise of the Eclectic and Naturalist schools in Italy, and of a courtly art, based upon the classic, in France, whose art in Italy also perfected the classic landscape. It was the golden age of painting in Spain, Flanders and Holland. Spain developed a great religious art, combining Catholic devotion with a trenchant realism, and a marvelous portraitist in Velazquez. The Flemish School was also realistic, but more influenced by Italy, and less religious in character. In Holland, a

highly developed national realism, practically uninfluenced from without, found expression in panels of portrait, genre, landscape, animal, and still life. The eighteenth century witnessed in France the light, graceful and decorative painting of the Rococo, and the rise in England of a bourgeoisie art, showing a curious admixture of Eclectic Italian influence with realism, and foreshadowing that of the nineteenth century. See Section *Seventeenth and Eighteenth Centuries* in the article on PAINTING.

1. *Italy:*

Bolognese School of Painting
Carracci
Domenichino
Reni, Guido
Guercino
Dolci, Carlo
Caravaggio
Rosa, Salvator
Giordano, Luca
Tiepolo
Canaletto
Guardi, Francesco
Carriera, Rosalba

2. *France:*

Poussin, Nicolas
Gelé, Claude (Claude Lorrain)
Lebrun, Charles
Mignard, Pierre
Champagne, Philippe de
Watteau, Antoine
Fragonard, Jean Honoré
Chardin, Jean Siméon
Lancret, Nicolas
Boucher, François
La Tour, Maurice
Quentin
Greuze, Jean Baptiste
Vigée-Lebrun

3. *Spain:*

Herrera the Elder
 Ribera, Jusepe
 Velazquez
 Zurbaran
 Cano, Alonzo
 Coello, Claudio
 Murillo
 Goya y Lucientes

4. *Flanders:*

Rubens, Peter Paul
 Van Dyck, Anthonis
 Jordaens, Jacob
 Snyders, Frans
 Fyt, Jan
 Teniers the Younger
 Brouwer, Adriaen

5. *Holland:*(a) *Portraiture (q. v.):*

Mierevelt, Michiel
 Hals, Frans
 Rembrandt
 Maes, Nicolas
 Helst, Bartholomeus van der

(b) *Genre (q. v.):*

Ostade, Adriaen van
 Dou, Gerard
 Steen, Jan
 Terborch, Gerard
 Metzu, Gabriel
 Hooch, Pieter de
 Vermeer van Delft

(c) *Landscape (q. v.), etc.:*

Goyen, Jan van
 Ruysdael, Salomon
 Neer, Aert van der
 Ruisdael, Jacob
 Hobbema, Meindert
 Potter, Paulus
 Velde, Adriaen van de
 Cuyp, Albert
 Backhuysen, Ludolf

Velde, Willem van de, the
 Younger

Heem, Jan de
 Huysum, Jan van
 Beyeren, Abraham van
 David, Gerard
 Weenix, Jan
 Hondecoeter, Melchior

6. *England:*

Lely, Sir Peter
 Kneller, Sir Godfrey
 Hogarth, William
 Reynolds, Joshua
 Gainsborough, Thomas
 Romney, George
 Wilson, Richard
 Morland, George

VI. MODERN PAINTING.

1. *France.*

During the nineteenth century the hegemony of Europe in the fine arts belonged to France. Rococo art was succeeded in the last part of the eighteenth century by Classicism, which found the chief beauty of painting in form, as revealed in ancient sculpture. The reaction upon Classicism was Romanticism (from c. 1830), which used painting as an expression of the artist's emotional nature, and placed the chief emphasis upon color and natural truth. The Barbizon School represents the emotional impulse of Romanticism, as applied to landscape, animal painting, and peasant subjects. The third great factor in French painting is Realism, advocating the abolition of academic law and sentiment, and the exact presentation of natural truth. Then came Impressionism (1874), so called from a tendency to render momentary impressions, but which sought,

above all, to paint evanescent effects of light. Post Impressionism is a reaction on both Impressionism and Realism, which endeavors to paint pure feeling in purely abstract form and color. See:

(a) Classicists:

David, Jacques Louis
Prudhon, Pierre
Gros, Antoine Jean
Ingres, Jean Auguste Dominique

(b) Romanticists:

Géricault, Jean Louis
Delacroix, Eugène
Décamps, Alexandre Gabriel
Fromentin, Eugène
Vernet, Horace
Couture, Thomas
Regnault, Henri

(c) Eclectics:

Delaroche, Paul
Bouguereau, Guillaume Adolphe
Scheffer, Ary

(d) Barbizon Painters:

Corot, Camille
Rousseau, Théodore
Dupré, Jules
Díaz de la Peña
Daubigny, Charles François
Millet, Jean François
Troyon, Constant
Jacques, Charles
Cazin, Jean Charles

(e) Realists:

Courbet, Gustave
Bonnat, Léon
Duran, Carolus
Fantin-Latour
Meissonier, Ernest
Neuville, Alphonse Marie de
Détaille, Edouard

(f) Impressionists, etc.:

Impressionist Painting
Manet, Edouard
Renoir, August
Degas, Hilaire Germain
Raffaelli, Jean François
Monet, Claude
Pissaro, Camille
Sisley, Alfred
Besnard, Paul Albert

(g) Post Impressionists:

Post Impressionism
Cézanne, Paul
Gauguin, Paul
Matisse, Henri
Picasso, Pablo
Picabia, Francis

(h) Various Tendencies:

Flandrin, Jean Hippolyte
Puvis de Chavannes
Moreau, Gustave
Gérôme, Jean Léon
Vollon, Antoine
Bonheur, Rosa
Bastien-Lepage
Dagnan-Bouveret
Lhermitte, Léon

2. *Germany (including Austria).*

In Germany the reaction against Classicism first took the form of an imitation of Italian masters of the fifteenth century (Nazarenes). Extensive demand for mural decoration at Munich produced the so-called cartoon (q. v.) style, in which color was neglected. The Düsseldorf School represented the romantic tendencies of German art, chiefly in panel-painting. About 1850 a great change was effected by French and Belgian colorists; since 1870 Realism and since 1880 Impressionism have found entrance. The

most recent tendencies have been very radical (see *SECESSION*) and decorative in character, especially in Vienna. See:

Pre-Raphaelites
 Düsseldorf School of Painting
 Mengs, Raphael
 Kauffmann, Angelica
 Overbeck, Johann Friedrich
 Cornelius, Peter von
 Kaulbach, Wilhelm von
 Rethel, Alfred
 Schwind, Moritz von
 Feuerbach, Anselm
 Makart, Hans
 Max, Gabriel
 Munkácsy, Michael
 Knaus, Ludwig
 Defregger, Franz von
 Grützner, Eduard
 Menzel, Adolf
 Lenbach, Franz
 Leibl, Wilhelm
 Böcklin, Arnold
 Liebermann, Max
 Klinger, Max
 Thoma, Hans
 Uhde, Fritz von
 Gebhard, Eduard
 Kampf, Arthur
 Zügel, Heinrich
 Stuck, Franz

3. *Great Britain.*

The chief aim of British art during the early nineteenth century was historical pictures of an academic order. Landscape painting culminated in Turner and Constable. A reaction against the academic came about through the Pre-Raphaelites (q. v.), who introduced spiritual and realistic elements. The chief influence in recent years has been French. See:

Raeburn, Sir Henry
 Lawrence, Sir Thomas
 Hoppner, John
 Haydon, Benjamin Robert
 Eastlake, Sir Charles
 Blake, William
 Wilkie, David
 Turner, J. M. W.
 Crome, John
 Constable, John
 Rossetti, Dante Gabriel
 Hunt, William Holman
 Burne-Jones, Sir Edward
 Millais, Sir John Everett
 Watts, George Frederick
 Herkomer, Hubert
 Leighton, Frederick, Lord
 Alma-Tadema, Lawrence
 Orchardson, W. Q.
 Lavery, John
 Hornell, Edward
 Shannon, James J.

4. *Other Countries.*

In other European countries the development through the Classical, Romantic, and Naturalistic stages was not dissimilar to those already described. All have profited by French technical methods, and are, to a greater or less extent, swayed by Realistic and Impressionistic tendencies. See:

(a) *Belgian and Dutch:*

Gallait, Louis
 Leys, Baron Hendrik
 Wiertz, Antoine Joseph
 Stevens, Alfred
 Lempoels, Jeff
 Khnopff, Fernand
 Israels, Josef
 Mesdag, Hendrik
 Mauve, Anton
 Maris, The Brothers

Gogh, Vincent van
Toorup, Jan

(b) Scandinavian and Russian:

Zorn, Anders
Larsson, Carl
Liljefors, Bruno
Kroyer, Peter Severin
Thaulow, Frits
Vereshtchagin, Vassili
Repin, Ilia Yefimovitch

(c) Spanish, etc.:

Fortuny, Mariano
Sorolla, Joaquin
Segantini, Giovanni

5. *United States.*

During the Colonial period and immediately after the Revolution, British influences prevailed in the United States, with an inclination to follow the Italians in larger subjects. An indigenous art began with the self-taught Hudson River School, about 1825. Then came the foreign influence, and, since 1875, French methods have been quite generally adopted, the natural characteristics revealing themselves in choice of subject and conceptions.

(a) Early Period:

West, Benjamin
Copley, John Singleton
Peale, Charles Wilson
Trumbull, John
Stuart, Gilbert
Allston, Washington
Peale, Rembrandt
Sully, Thomas
Jarves, John Wesley

(b) Middle Period:

Hudson River School of Painting
Cole, Thomas
Durand, Asher Brown

Kensett, John Frederick
Church, Frederick Edwin
Bierstadt, Albert
Moran, Thomas
Harding, Chester
Neagle, John
Inman, Henry
Huntington, Daniel
Fuller, George
Ryder, Albert P.
Johnson, Eastman
Brown, John G.
Mount, William Sidney
Leutze, Emanuel
Hicks, Thomas
Hunt, William Morris
Homer, Winslow
Inness, George
Wyant, A. H.
Martin, Homer D.

(c) Third, or Cosmopolitan, Period:

(i) Figure and Portrait:

Whistler, James Abbott Mc-
Neil
Abbey, Edwin A.
Sargent, John Singer
Vedder, Elihu
Duveneck, Frank
Dielman, Frederick
Chase, William Merrit
Eaton, Wyatt
Weir, James Alden
Thayer, Abbott
Brush, George De Forest
Tarbell, Edmund
Benson, Frank Weston
Dewing, Thomas W.
Blum, Robert F.
Walker, Horatio
Remington, Frederick
Couse, E. Irving
Wiles, Irving
Alexander, John W.

Decamp, Joseph R.
 Eakins, Thomas
 Beaux, Cecilia
 Harrison, (Thomas) Alexander
 Melchers, Gari
 Cassatt, Mary

(ii) Landscape:

Dewey, Charles Melville
 Blakelock, Ralph
 Dearth, Henry Golden
 Wiggins, Carlton
 Robinson, Theodore
 Bunce, William Gedney
 Murphy, John Francis
 Crane, Bruce
 Harrison, (Lovell) Birge
 Twachtman, John Henry
 Dougherty, Paul
 Hassam, Childe
 Foster, Ben
 Schofield, W. Elmer
 Redfield, Edward Willis
 Symons, Gardner
 Chapman, Carlton T.
 Waugh, Frederick Judd
 Carlsen, Emil

(iii) Mural Painting (q. v.):

La Farge, John

Cox, Kenyon
 Blashfield, Edwin H.
 Mowbray, Henry Siddons
 Rogers, H. O.
 Millet, Frank D.
 Oakley, Violet

(iv) Recent Tendencies:

Henri, Robert
 Bellows, George
 Lie, Jonas
 Lawson, Ernest
 Mora, Luis
 Hawthorne, Charles W.
 Miller, Richard E.
 Friesecke, Frederick Carl
 Dabo, Léon

VI. PASTEL, WATER-COLOR, AND MINIATURE PAINTING.

The basis of study should be the general articles on these three varieties of painting, which discuss their technique and history and enumerate the principal artists. The most important of the latter are treated as special titles, to which reference should be made.

Chapter 12. The Minor Arts

A. Engraving

Engraving is the art of producing on a hard surface, such as stone, metal, or wood, incised or relief designs. These may be for purposes of decoration, as in the case of engraved bronzes and silverware, or for stamping a soft substance, as seal rings. But engravings are usually made for the purpose of printing upon paper, and it is this variety with which we are chiefly concerned.

Printing is done either from incised designs to which the ink is applied, or from relief designs, which thus produce the image. In the first process, metal plates, usually of copper, are used; the principal varieties are Line-Engraving and Etching, to which may be added Dry Point, *Manière Criblée*, and Stipple. The chief form of Engraving in relief is Wood-Engraving; and there are mixed processes, like Aquatint, Mezzotint, and Soft-Ground Etching. The trial impressions upon paper are called the proofs, and the final result the print. The article ENGRAVING contains a general sketch of the subject. See also:

- Line Engraving
- Etching
- Dry Point
- Manière Criblée*
- Stipple
- Wood Engraving
- Aquatint
- Mezzotint
- Soft-Ground Etching
- Print Proof

I. LINE ENGRAVING.

Line Engraving is done with the burin, usually upon a copper plate. It

originated simultaneously in Italy and Germany during the early fifteenth century, probably with the goldsmiths, from the custom of printing trial impressions of niello plates. (See NIELLO.) The earliest line-engravings are mere outline drawings without light or shade. In the early sixteenth century, the art culminated in the works of Albrecht Dürer in Germany, Lucas van Leyden in Holland, and Marcantonio Raimondi in Italy. During the seventeenth century, especially under Louis XIV, France was predominant. But artists devoted themselves increasingly to the reproduction of great paintings instead of original designs. For this reason, the art has gradually sunk into disuse, its place being taken by photographic processes. See:

- Line-Engraving (basis of study)
- Burin
- Niello

1. Italy:

- Finiguerra, Tomaso
- Jacopo dei Barbari
- Mantegna, Andrea
- Raimondi, Marcantonio
- Carracci, Agostino
- Piranesi, Giambattista
- Morghen, Raffaello

2. Germany; Netherlands:

- Schongauer, Martin
- Dürer, Albrecht
- Lucas van Leyden
- Beham, Hans Sebald
- Beham, Barthel
- Vorsterman, Lucas
- Chodowiecki, Daniel

3. *England:*

Strange, Sir Robert
Vertue, George

4. *France:*

Bosse, Abraham
Nanteuil, Robert
Masson, Antoine
Audran, Gérard
Cochin, Charles Nicolas
Forster, François
Henriquel-Dupont, Louis Pierre
Gaillard, Claude Ferdinand

II. ETCHING.

In etching, the plate is covered with the ground, usually a varnish, into which the design is scratched with an etching-needle. The plate is then immersed in an acid, which eats the design into the metal. The finishing touches are often done by the dry-point process, a simple scratching of the plate without the use of ground or acid.

Etching upon steel armor, etc., was practiced in the Middle Ages. Dürer was one of the first to use etching for printing purposes, and the art reached its highest development in Holland during the seventeenth century. Many eminent painters practiced it, among whom was the greatest etcher of all times, Rembrandt. Next to Holland, etching was principally cultivated in France, beginning with Claude Lorrain's landscapes. The art found a revival in the nineteenth century, especially in France, but also in England, Germany, and the United States. The following list cites only the principal etchers and a few of the important painters who have practiced etching. See *Etching* (basis of study):

1. *Netherlands:*

Lucas van Leyden
Velde, Esaias van de
Rembrandt
Ruisdael, Jacob
Potter, Paul
Van Dyck, Anthonis

2. *France:*

Gelée, Claude (Claude Lorrain)
Flameng, Leopold
Rajon, Paul
Méryon, Charles
Jacquemart, Jules Ferdinand
Legros, Alphonse
Helleu, Paul

3. *Germany:*

Hollar, Wenzeslas
Unger, William
Klinger, Max
Thoma, Hans
Liebermann, Max

4. *Spain:*

Goya, Francisco

5. *England:*

Geddes, Andrew
Wilkie, Sir David
Turner, J. M. W.
Hamerton, Philip Gilbert
Haden, Francis Seymour
Menpes, Mortimer
Brangwyn, Frank

6. *United States:*

Whistler, James Abbott McNeil
Pennell, Joseph
Moran
Parish, Stephen
Platt, Charles A.
Webster, Herman A.

III. WOOD ENGRAVING.

In early Wood Engraving, the design, and the early wood engraving at-

block, and all the wood was cut away except the design, which remains in relief. The process is of peculiar importance because it can be used in connection with printing from movable types.

Crude outline prints from wood-cuts were common in Southern Germany and the Netherlands in the early fifteenth century. The art received an impetus from the invention of printing, and the early wood-engraving attained its most perfect development during the early sixteenth century in the works of Albrecht Dürer and Hans Holbein in Germany. It was introduced by German artists into Italy; but here only the *chiaroscuro* process attained a high degree of proficiency. (See paragraph *Chiaroscuro* under WOOD ENGRAVING.) Wood engraving flourished also in the Netherlands and in France.

Modern wood engraving is done on the cross-grain of boxwood, and with a graver instead of the knife. The design is cut away instead of being left in relief, appearing in white lines. The father of the art was the Englishman, Thomas Bewick (died in 1828), although his pupils achieved much as book illustrators. The art has, during late years, succumbed in England to the more accurate photographic processes. Present German wood engraving is, generally speaking, precise and careful in execution; but the French school has attained the highest artistic perfection.

Before the Civil War, America produced several prominent wood engravers whose work resembled contemporary British. But after 1870, in connection with the popular magazines, a

school, headed by Timothy Cole, arose which reproduced the effect of paintings, drawings, etc., with remarkable fidelity, and used the technical proficiency acquired to render portraits and landscapes. Since the perfection of the photographic processes, wood engravers have returned to a more legitimate practice of their art wood engraving. See:

1. *Germany:*

Dürer, Albrecht
 Burckmair, Hans
 Schäuffelein, Hans
 Holbein the Younger
 Lützelburger, Hans
 Cranach, Lucas
 Altdorfer, Albrecht
 Beham, Hans Sebald
 Aldegrever, Heinrich
 Baldung, Hans
 Menzel, Adolf
 Richter, Ludwig

2. *France:*

Cousin, Jean
 Charpentier, François
 Bracquemond, Joseph Auguste
 Johannot, Tony
 Grandville
 Gavarni
 Doré, Gustave

3. *Italy:*

Carpi, Ugo da
 Andreani, Andrea

4. *England:*

Bewick, Thomas
 Blake, William
 Linton, William James

5. *United States:*

Anderson, Alexander
 Smillie, James D.

Danforth, Moseley Isaac
 Cole, Timothy
 Juengling, Frederick
 Kruell, Gustav
 Wolf, Henry

IV. LITHOGRAPHY.

In lithographic processes, the design is drawn with crayon or fatty ink upon a porous stone or metal, possessing the property of retaining fatty substances and water to the evaporating point. The remainder of the stone is moistened with water. A roller covered with fatty printing ink will retain only the design, being repelled by the moist portions. Lithography was invented in 1798, by Aloys Senefelder, at Munich. Since the invention of the power press, it has become a world-wide industry. See:

Lithography
 Senefelder, Aloys
 Whistler, James Abbott McNeil
 Pennell, Joseph

The principal artists cited under
LITHOGRAPHY.

V. PHOTO-ENGRAVING.

This is a mechanical process in which the plates are prepared from a photographic negative by means of the action of light upon gelatine and other substances. It may be intaglio, in which the French name *photogravure* is used, or relief. The finishing touches are done by hand. The half-tone process, now generally used for purposes of illustration, is done on plates of ruled lines of extreme fineness. See **PHOTO-ENGRAVING.**

VI. ILLUSTRATION.

The article **ILLUSTRATION** treats the decoration and illustration of books,

and its history from the Egyptian papyri to the modern newspaper. This should be supplemented by **ILLUMINATED MANUSCRIPTS**, treating especially the Middle Ages and Renaissance. With the invention of printing, wood engraving (q. v.) became the principal means of illustration. Since 1850 photo-engravings have been increasingly used, and, in recent years, colored illustrations, some of great beauty, have been produced, especially in the leading magazines. The article **CARICATURE** describes in detail the important influence of that factor of illustration. The principal illustrators are enumerated there, under **WOOD-ENGRAVING**, and in the list subjoined.

1. *France:*

Callot, Jacques
 Daumier, Honoré
 Gavarni
 Cham
 Caran d'Ache
 Forain, Jean Louis
 Willette, Léon Adolphe

2. *England:*

Gilray, James
 Cruikshank, George
 Doyle, John
 Leech, John
 May, Phil
 Du Maurier, George
 Tenniel, Sir John
 Crane, Walter
 Beardsley, Aubrey Vincent

3. *United States:*

Nast, Thomas
 Gibson, Charles Dana
 Christy, Howard Chanler
 Fisher, Harrison
 Flagg, James Montgomery

Chapter 13. Music

TO appreciate music requires chiefly a receptive temperament. Obviously, the more one understands of the technique whereby certain harmonious results are produced, the greater will be the enjoyment of those results. But, irrespective of the critical interest in music, its first appeal must be, and is, to the imagination and the emotions. The layman in the audience is not thrilled by the cold, technical fact that the violinist, yonder on the stage, is producing that wonderfully soft, birdlike note by the infinitesimal, *even* pressure of his little finger on the highest possible note of the A string. The musicians, the violinists, the critics, realize the years of study that have contributed to the production of that perfect note, and their admiration is greater, but their enjoyment of the emotional result is no more keen, than that of the musical proselyte beside them.

This theory, which is based on actualities, finds its logical expression in the system that has been adopted in outlining the department of Music in the *New International Encyclopædia*. There is, first, a synopsis of the articles which would interest the general reader by giving an historical and appreciative résumé of music as an art. The second subdivision is more especially for the student, or for the reader who desires to master the technique and science of music, in order that he may "see with an understanding eye" and hear with a critical nicety of discrimination.

1. INTRODUCTORY.

Music
Music, History of
Sacred Music
Opera (with the accompanying
lists of operas)
Oratorio (with the accompanying
list of oratorios)
Instrumental Music
Musical Instruments (with cross
references to individual arti-
cles or instruments, under
their own names)
Orchestra
Score
Band
Band, Military
Organ
Pianoforte
Violin
Singing

Dancing (with cross references
to separate articles)

2. HISTORICAL.

Folk-Music
Egyptian Music
Hindu Music
Chinese Music
Japanese Music
Hebrew Music
Greek Music
Magyar Music
Arabian Music
Scandinavian Music
Slavonic Music
Spanish Music
Janizary Music
Celtic Music
Finnish Music
Scotch Music
Indian Music
Negro Melodies

Minnesinger
 Troubadours
 Trouvère
 Waits
 Ambrosian Chant
 Gregorian Chant
 Hymnology
 National Hymns

3. MUSICAL ORGANIZATIONS, ETC.

Guilds, Musical (under Guild)
 Conservatory
 Conductor
 Precentor
 Musical Festival
 Gesellschaft der Musikfreunde
 Gewandhaus-Concerte
 Leeds Musical Festival
 Choral Societies
 Handel and Haydn Society
 Oratorio Society
 Singakademie
 Philharmonic Societies
 Boston Symphony Orchestra
 Société des Concerts du Conservatoire
 Sons of the Clergy Musical Festival
 Chicago Symphony Orchestra
 Cincinnati Symphony Orchestra
 Minneapolis Symphony Orchestra
 Three Choirs Festival
 Bethlehem, Musical or Bach Festival
 Worcester Musical Festival
 Peterboro Musical Festival
 Bayreuth Musical Festival

4. THE ART-FORMS.

Canon
 Cantata
 Catch
 Chaconne

Chamber Music
 Chant
 Chorale
 Concerto
 Cyclical Forms
 Duet
 Étude
 Fantasia
 Form
 Fugue
 Glee
 Humoreske
 Imitation
 Incidental Music
 Interlude
 Intermezzo
 Introduction
 Legend
 Leitmotiv
 Lied
 Musical Drama
 Nocturne
 Offertory
 Overture
 Paraphrase
 Passion
 Pasticcio
 Postlude
 Pot-pourri
 Prelude
 Programme Music
 Quartet
 Recitative
 Requiem
 Rhapsody
 Rondo
 Scherzo
 Serenade
 Singspiel
 Solo
 Sonata
 Song
 Suite
 Symphonic Poem

Symphony
Trio
Variation

Virginal
Transposing Instruments
Valves in Musical Instruments
(under Valve)
Voice

5. DEFINITIONS AND DESCRIPTIONS OF
TERMS AND PROCESSES USED IN
THE INTERPRETATION OF MUSIC.

See also PIANO, ORGAN, SINGING,
and MUSICAL INSTRUMENTS.

Musical Dictation

Beat

Baton

Rest

Tempo

Temperament

Rhythm

Syncopation

Expression

Musical Notation

Modulation

Intonation

Fingering

Position

Touch

Phrasing

Slide

Swell

Register

Augmentation

Movement

Passing Notes

Tremolo

Trill

Treble

Bass

Neumes

Value

Clang Tint, Explanation of

Finger-board

Clavichord

Janko Keyboard

Harpsichord

Manual

Metronome

Pedal

String

6. MISCELLANEOUS AND TECHNICAL
ARTICLES.

The reader who has followed the
course outlined in the earlier subdi-
visions, will find that the following ar-
ticles are mainly specialized statements
of general principles with which he is
already familiar:

HARMONY:

Antiphony

Bar

Cadence

Cantus Firmus

Chord

Chromatic

Clef

Coda

Consonance

Degree

Diatonic Scale

Diazeutic Tone

Discord

Dissonance

Dominant

Figured Bass

Finale

Flat

Fundamental Note

Grace-notes

Guidonian Hand

Harmonics

Homophony

Improvisation

Instrumentation

Interval

Invention
 Inversion
 Key
 Leading Tone
 Leading of Voices
 Leger-Lines
 Major
 Measure
 Mediant
 Melody
 Meloplaste
 Melos
 Mensurable Music
 Metre
 Minor
 Mixed Cadence
 Modes
 Monody
 Motion
 Motive
 Natural
 Nuances
 Numerical Notation
 Octave
 Organ-Point
 Organum
 Part
 Part-music
 Passage
 Passing Notes
 Pitch
 Plain Chant
 Polyphony
 Preparation
 Principal
 Progression
 Reed
 Relationship
 Scale
 Semitone
 Sequence
 Sharp
 Solmization
 Subdominant

Suspension
 Tablature
 Theme
 Tierce
 Tonality
 Tone
 Tonic
 Tonic Sol-fa
 Touch
 Transcription
 Transposition
 Triad
 Triplet
 Typical Phrase
 Unison
 Variation

BIOGRAPHY.

A selected list of the world's great composers would include the following names :

Adam, A. C.
 Agricola, M.
 d'Albert, E.
 Allegri, G.
 Anerio, F.
 Animuccia, G.
 Arcadelt, J.
 Arne, T. A.
 Auber, D. F. E.
 Bach, J. S.
 Bach, K. P.
 Balfe, M. W.
 Barnby, J.
 Beethoven, L.
 Bellini, V.
 Benedict, J.
 Bennett, W. S.
 Berlioz, H.
 Bizet, G.
 Boieldieu, F. A.
 Bononcini, G. B.
 Brahms, J.
 Bruneau, A.

Bull, J.
Buxtehude, D.
Caccini, G.
Cambert, R.
Carissimi, G.
Cavalieri, E.
Cherubini, M. L.
Chopin, F. F.
Cimarosa, D.
Clementi, M.
Corelli, A.
Cornelius, P.
Couperin, F.
Cui, C.
David, F. C.
Debussy, C.
Deprès, J.
Donizetti, G.
Durante, F.
Dvorák, A.
Elgar, E.
Enna, A.
Festa, C.
Field, J.
Flotow, F.
Franck, C.
Franz, R.
Frescobaldi, G.
Froberger, J. J.
Gabrieli, A.
Gabrieli, G.
Gade, N. W.
Gibbons, O.
Giordano, U.
Glinka, M. I.
Gluck, C. W.
Goldmark, K.
Gossec, F. J.
Goudimel, C.
Gounod, C. F.
Graun, K. H.
Grétry, A. E. M.
Grieg, E.
Halévy, J. F.

Handel, G. F.
Haydn, J.
Hérold, L. J. F.
Hiller, J. A.
Hofhaimer, P.
Hunfrey, P.
Hummel, J. N.
Humperdinck, E.
d'Indy, V.
Ippolitov-Ivanov, M.
Isaak, H.
Isouard, N.
Jommelli, N.
Keiser, R.
Kiel, F.
Lalo, E.
Lasso, Orlando di
Leo, L.
Leoncavallo, R.
Le Sueur, J. F.
Liszt, F.
Logroscino, N.
Lortzing, G. A.
Lotti, A.
Lully, J. B.
MacDowell, E. A.
Mahler, G.
Marschner, H.
Mascagni, P.
Massenet, J. E. F.
Mendelssohn-Bartholdy, F.
Meyerbeer, G.
Monteverde, C.
Morley, T.
Mozart, W. A.
Mussorgsky, M.
Nanini, G. M.
Offenbach, J.
Okeghem
Pachelbel, J.
Paisiello, G.
Palestrina, G. P.
Pergolese, G. B.
Piccini, N.

Ponchielli, A.
Porpora, N. A.
Prätorius, M.
Puccini, G.
Purcell, H.
Raff, J.
Rameau, J. P.
Reger, M.
Rimski-Korsakov, N.
Rossini, G. A.
Rubinstein, A.
Sacchini, A. M.
Saint-Saëns, C. C.
Scarlatti, A.
Schubert, F.
Schumann, R.
Schütz, H.
Sibelius, J.
Sinding, C.
Smetana, F.
Spohr, L.
Spontini, G. L.
Strauss, J.
Strauss, R.
Sullivan, A. S.
Suppé, F.
Tchaikovsky, P. I.
Thomas, A.

Tartini, G.
Verdi, G.
Viotti, G. B.
Volkman, R.
Wagner, R.
Wallace, W. V.
Weber, K. M.
Willaert, A.
Wolf, H.
Zingarelli, N. A.

NOTE—The names of famous operas, oratorios, symphonies, dances, and national hymns have been omitted from the above classification. In the majority of cases, they will be found under their own proper titles, although brief mention of them would also be found in the general articles **OPERA**, **ORATORIO**, **SYMPHONY**, and **NATIONAL HYMNS**. The same is true of the scores of musical instruments and musical directions whose names will be found under the general articles **ABBREVIATIONS**, **MUSICAL INSTRUMENTS** and **TEMPO**.

Chapter 14. Mathematics

ROUGHLY defined, mathematics is the science of forms and number. A few of the definitions given by eminent mathematicians are found in the general article **MATHEMATICS**, which is, therefore, a suitable introduction to the subject. The article gives a condensed history of mathematics, from earliest times to the present, together with a logical classification of the various branches of mathematics.

Mathematical science naturally falls into two main subdivisions: Pure Mathematics and Applied Mathematics. With this division as a basis, various classifications have been attempted. The best classification for the purpose of systematic reading is the one usually followed in the school curriculum, or in the text-books. In accordance with this, we may subdivide Elementary Mathematics into the following branches:

Arithmetic
Algebra
Geometry
Trigonometry
Analytic Geometry
Calculus

Division
Arithmetic Signs
Fraction
Involution and Evolution
Proportion
Checking in Arithmetic
Calculating Machines
Slide Rule

1. **ARITHMETIC** involves three phases: The conception of number, the representation of number by symbols, and the principles and methods of computation. A general discussion of these phases, together with their history, is given in the article **ARITHMETIC**, which, therefore, should be read as an introduction to this branch.

A more modern phase of arithmetic is computation by calculating machines. This process has already to a large extent replaced computations by hand, and seems to be destined to do so even more in the future.

The general articles bearing on this branch may be conveniently read in the following order:

(a) *Principles and Methods of Computation:*

Addition
Subtraction
Multiplication

(b) *Symbols, Representation, and Scales:*

Symbols
Numerals
Decimal System
Scales of Notation

(c) *Theory of Numbers:*

Number
Irrational Number
Complex Number

The detailed history of these topics is given separately in each article.

2. **ALGEBRA** is universal arithmetic, and has many features in common with arithmetic. The fundamental operations are the same, with the exception that algebra takes up the more general cases. The limitations of algebra are brought out in the general article **ALGEBRA**, where also a history of this branch is given. Since algebra and

arithmetic are so closely related, the fundamental operations are best treated together, and so the general articles bearing on the fundamental operations in algebra have been given under arithmetic. Those belonging almost exclusively to algebra are best taken up in the following order:

Coefficient
Factor
Exponent
Associative Law
Polynomial
Negative Quantity
Binomial
Binomial Coefficients
Binomial Theorem
Remainder Theorem
Equation
Elimination
Substitution
Diophantine Analysis
Series
False Position, Rule of
Cubic Equation
Biquadratic Equations
Permutations and Combinations
Probability
Determinants
Logarithms
Analysis

3. **GEOMETRY** is the science of form, and geometric concepts arise from the consideration of forms of objects just as numerical concepts arise from considering a collection of objects. Geometry is independent of algebra, and may be studied before or after algebra, but preferably after. The physical scientist considers only the space we live in, while the mathematician considers all possible spaces. Accordingly, we have many different kinds of geometry. A general classification and dis-

cussion of the several geometries is given in the article **GEOMETRY**. Although algebra and geometry are independent, a correspondence may be set up between them. This is brought out in the article **CORRESPONDENCE**. The general articles are best read in the following order:

Euclid
Axiom
Theorem
Problem
Corollary
Angle
Arithmetic and Geometric Signs
Equiangular
Equilateral
Congruence
Duality
Construction
Locus
Triangle
Circle
Quadrilateral
Polygon
Circumscribed and Inscribed Figures
Contact
Perimeter
Transversal
Antiparallels
Concurrence and Collinearity
Maxima and Minima
Similarity
Symmetry
Plane
Octahedron
Polyhedron
Projective Geometry
Projection
Homology
Perspective
Isoperimetric Figures
Engineering Instruments
Surveying

Planimeter
Mensuration
Protractor
Vernier
Quadrature
Weights and Measures
Duplication of Cube (under Cube)
Quadrature of Circle (under Quadrature)
Trisection of an Angle

4. **TRIGONOMETRY** in elementary mathematics deals with the study of triangles, and the measurement of their sides, angles, and areas. This is, however, only a part of the general subject. Under the article **TRIGONOMETRY**, almost a whole text-book treatment is given, together with a short history of the subject from earliest times. As an introduction, read the article **LOGARITHMS**. An elementary knowledge of algebra and geometry is, however, necessary before the study of trigonometry can be taken up.

5. **ANALYTIC GEOMETRY** is the application of algebra to geometry, and the combination of the two is the most powerful tool of the modern mathematician. More general results may be deduced, and better classification effected, by means of analysis. In the general article **ANALYTIC GEOMETRY**, the aim and general method of procedure is given, together with a short history of the subject. The other articles may be conveniently read in the following order:

Coördinates
Graphic Method
Curve
Analysis
Cartesians
Parameter
Locus

Contact
Normal
Tangent
Conic Sections
Circle
Pole and Polar
Parabola
Ellipse
Hyperbola
Surface
Cone
Conoid
Spheroid
Generation

Higher Plane Curves:

In these, are included all transcendental and all algebraic curves above the second order. As an introduction, read the article **CURVE**. Some of the most important articles are:

Cardioid
Catenary
Cissoid
Conchoid
Curve of Sines
Cycloid
Logarithmic Curve
Spiral
Lemniscate
Loxodrome
Witch

6. **CALCULUS**. This term usually refers to Differential and Integral Calculus. Differential Calculus deals with the relation between indefinitely small quantities or infinitesimals, and is of great service when the quantities under consideration are constantly changing. The problem of Integral Calculus is the inverse of that of Differential Calculus. Integral Calculus also deals with the application of calculus to mechanics and geometry.

In the general article **CALCULUS**, the methods and applications of calculus are illustrated by the solution of practical problems. As a historical introduction, read:

Indivisibles (under Cavalieri)

Fluxions

The general article **CALCULUS**, should also be preceded by:

Analysis

Limits, Theory of

Infinity and the Infinitesimal

and followed by:

Maclaurin's Theorem (under Mac-
laurin)

Curve

Osculation

Quadrature

Differential Equations (under Equa-
tion)

7. **HIGHER MATHEMATICS** is a collective term for all branches of mathematics that follow calculus. Most of these branches are based on calculus, but some, like the theory of numbers and group theory, are independent of calculus. The following articles will furnish an introduction to some of the branches of higher mathematics:

Forms

Functions

Modern Geometry (under Geome-
try)

Non-Euclidean Geometry (under
Geometry)

Quaternions

Substitution

Theory of Numbers (under Num-
ber)

8. **APPLIED MATHEMATICS** deals with the application of mathematics to related sciences, like Mechanics, Astronomy, Physics, etc. See these departments in this work.

9. **BIOGRAPHY.** Mathematical knowledge dates back to the Egyptian and Babylonian civilizations, but the real development begins in Greece. This was chiefly in the realms of geometry. Later it inclined toward arithmetic. The Romans did nothing for mathematics, and the Arabs very little more than to translate and preserve the Greek learning. Through them it was introduced into the cloisters in Europe during the Middle Ages. The modern period in the history of mathematics begins with Descartes's invention of analytic geometry. The following is a list of the most eminent mathematicians, arranged according to their nationality or period:

(a) *Greek:*

Thales

Pythagoras

Aristotle

Plato

Euclid

Archimedes

Diocles

Nicomedes

Hippias of Elis

Menelaus

Apollonius of Perga

Hero of Alexandria

Ptolemy

Diophantus

Pappus

(b) *Arab:*

Al-Khuwarizmi

Al-Battani

(c) *Hindu:*

Aryabhatta

Brahmagupta

Bhaskara
Mahavir

(d) *Persian:*

Omar Khayyam

(e) *From the revival of Mathematics
in Europe to the middle of the
17th century:*

Gerbert[under Sylvester(Pope)]
Fibonacci
Jordanus
Peurbach
Regiomontanus
Paccioli
Tartaglia
Cardan
Viète
Napier
Descartes

(f) *From the middle of the 17th cen-
tury to the present time:*

Desargues
Cavalieri
Pascal
Boscovich
Fermat
Wallis
Barrow, I.
Leibnitz
Newton
Bernoulli, Jakob
Bernoulli, Johann

Bernoulli, Niclaus
Bernoulli, Daniel
Maclaurin
Taylor
Euler
D'Alembert
Monge
Laplace
Lagrange
Legendre
Fourier
Gauss
Poisson
Poncelet
Chasles
Steiner
Cauchy
Möbius
Lobachevsky
Bolyai
Abel
Dirichlet
Hamilton
Jacobi
Plücker
Grassmann
Galois
Cayley
Eisenstein
Weierstrass
Riemann
Smith, H. J. S.
Sylvester
Clebsch
Lie, Sophus
Reye

Chapter 15. Astronomy

ASTRONOMY is the science which treats of the heavenly bodies—the sun and moon, the planets and their satellites, comets and meteors, the stars and nebulae. Astronomy is usually divided into many branches; these branches, however, are not distinct and separate, but overlap in all directions, so that no convenience as regards treatment is gained. The arrangement of the articles in the following lists is not according to branches, but in accordance with the order in which they may be conveniently read.

A general history of the progress of astronomical discovery is given in the general article **ASTRONOMY**, which, therefore, forms a suitable introduction to the subject. For a knowledge of a few of the elementary terms used in astronomy, see:

Zenith
Horizon
Equator
Ecliptic
Pole
Azimuth
Altitude
Declination
Latitude and Longitude
Parallels
Meridian
Diurnal Motion
Culmination

Chronometer
Spectroscope

(b) *Corrections to Astronomical Observations:*

Depression
Parallax
Refraction
Twilight
Aberration

(c) *Time:*

The determination of time is one of the most important problems in astronomy, and is effected by observing the time of transit across the meridian of some celestial object. For the determination of time, read:

Transit Instrument
Sextant
Chronometer
Ephemeris
Equation of Time

Various ways of reckoning time have been used in history. Some of the principal ways used by the ancients, and also those used at present, are given in the following articles:

Period
Chronology

1. ASTRONOMICAL OBSERVATIONS.

Astronomical observations are principally of two kinds: To determine distance, linear and angular; and to study the physical conditions of the heavenly bodies.

(a) *Instruments:*

Telescope
Sextant
Transit Instrument
Meridian Circle
Equatorial
Zenith Telescope
Micrometer
Chronograph

Calendar
Hour
Week
Day
Month
Year
International Date Line
Prime Meridian Conference
Time Signals
Time, Standard

Eros
Moon
Gravitation
Parallax
Lunar Theory
Nutation
Perturbations
Precession
Tides
Latitude, Variation of
Seasons
Orbit
Elements
Eclipse

2. THE SOLAR SYSTEM.

The solar system consists of the sun as a central body, around which revolve the planets with their satellites, some periodic comets, and meteoric swarms. In addition to these permanent members, the system is occasionally visited by other comets, which move in parabolic orbits. As a historical introduction, read:

Ptolemaic System
Copernican System

Of the members of the solar system, the planetary system is of most immediate interest to us, since our earth is a member of this system. The sun and the planets, with their satellites and their interrelations, are treated in the following articles:

Sun
Planets
Solar System
Planetoids
Satellites
Vulcan
Mercury
Venus
Earth
Mars
Jupiter
Saturn
Uranus
Neptune

COMETS are usually very small in mass, though this has great extent. They move in very eccentric orbits about the sun, and the planes of their orbits present a great variety. The constituent parts and physical characteristics, the mass, the spectra, the number, discoveries, the capture theory, and origin of comets are treated in the article COMET.

METEORS are masses of stone or iron, which sometimes are seen to fall to the earth from the sky. The circumstances of the fall, the meteoric showers, the probable cause, the matter, path, and number of meteors are treated in the articles:

Meteors
Aërolite

3. THE STARS.

These bodies are usually called fixed stars, owing to the idea of the ancients that they were without motion. The fixity is, however, now disproved, and observations with the spectroscope show that they are moving with velocities comparable to those of bodies belonging to the solar system. Owing to

their immense distance, they appear, however, to keep their relative positions and configurations unchanged. This is only apparent, and there are stars whose displacement amounts to as much as 1" a year. In magnitude and physical condition, the stars are comparable with our sun, and many of them greatly exceed our sun in brightness and magnitude. The designation, magnitude, nature, and number of stars, the constellations, stellar parallax, proper motion, spectra, photometry, variable stars, double and multiple stars, binary stars, etc., are treated in the following articles:

Star
 Constellation
 Culmination
 Pole Star
 Zodiac
 Galaxy
 Parallax
 Variable Star
 Astro-Photography

THE NEBULAE are faintly shining cloudlike patches of matter in the sky, scattered among the stars. They are supposed to be stars under formation. The nature, forms, and magnitudes of nebulae, the spectra, distribution, distance, etc., are treated in the article NEBULAE.

4. ASTRONOMICAL OBSERVATORIES are buildings where the instruments and machinery necessary for the observation of the heavenly bodies are kept. The equipment, location, etc., together with a description of some of the largest observatories in the world, are treated in the following articles:

Observatory
 Lick Observatory

Naval Observatory
 Pulkova
 Yerkes Observatory
 Greenwich Observatory
 Harvard College Observatory
 Mount Wilson Solar Observatory

5. COSMOGONY deals with the theory of operations by which the present condition of the universe came about. Various systems of cosmogony have prevailed at different times. See:

Cosmogony
 Nebulae

6. ASTROLOGY deals with the supposed influence of the heavenly bodies upon human affairs and the drawing of horoscopes. Astrology was the forerunner of astronomy, and for centuries astronomical observations were made mainly to supply data for astrology. See ASTROLOGY.

7. BIOGRAPHY.

Observational astronomy dates back to the Chinese and Chaldeans, but the first real attempt to explain the movements of the heavenly bodies is due to the Greeks. The ideas of the Greeks held sway till Copernicus substituted a more harmonious system. Gravitational astronomy begins with Newton, who made it possible to explain the movements of the heavenly bodies, while Galileo's invention of the telescope gave a means of finding out what they are in themselves. The following is a list of the most prominent contributors to astronomy:

Hipparchus
 Ptolemy
 Brahe
 Kepler
 Galileo

Galileo
Newton
Bradley
Halley
Roemer
Cassini, Jacques
Cassini, G. D.
Flamsteed
Herschel, Sir William
Herschel, Sir J. F. W.
Laplace
Bessel
Bode
Delambre
Olbers
Piazzi
Pond

Baily
Hansen
Struve, F. G. W.
Encke
Leverrier
Adams, J. C.
Airy
Rosse
Rutherford
Struve, Otto
Galle
Huggins
Lockyer
Gill, Sir David
Pickering
Hale, G. E.

Chapter 16. Physics

IN undertaking systematic reading in any particular science, it is well at the outset to realize the province and limitations of that science, as they have been determined and observed in the past by its devotees, and what, if there have been changes, is the modern conception of the scope of the particular department of knowledge so known. With this especial object, the article on **PHYSICS** has been written, and serves to introduce the reader to the subject, as discussed in more detail under the broad subdivisions of **ACOUSTICS**, **ELECTRICITY**, **HEAT**, **LIGHT**, **MECHANICS**, **LABORATORY**, **MAGNETISM** and **RADIOACTIVITY**. Taking up these subjects separately, and also the article on **LABORATORY**, we shall find in each case the general article referred to, and such minor articles as are demanded.

1. ACOUSTICS.

Dealing with theoretical questions, the more important topics on the nature and theory of sound are included in the following list:

- Acoustics
- Section *Origins* under Music
- Diatonic Scale
- Phonetics
- Resonance
- Resonator
- Node

For special purposes and investigation dealing with the production and propagation of sound waves, there has been devised much interesting apparatus, certain forms of which, as the telephone, phonograph, megaphone, etc., have found their way into universal application. See:

- Siren
- Speaking Trumpet
- Megaphone
- Ear-Trumpet
- Acoumeter
- Phonograph
- Talking Machine
- Graphophone
- Telephone
- Tuning-Fork
- Organ

2. ELECTRICITY.

To supplement the general article **ELECTRICITY**, and those of a theoretical nature treating Ionization and Electrons, it is desirable to consult articles dealing with the generation of the current, as **DYNAMO-ELECTRIC MACHINERY**, the **VOLTAIC CELL**, the **DRY PILE**, **THERMO-ELECTRICITY**, and also study the effects of **INDUCTION** and self-induction. We can learn how the magnetic strength of a solenoid is influenced by the number of **AMPERE TURNS**. As supplemental, then, to the article on electricity, the following articles may be cited:

(a) *Fundamental Phenomena:*

- Current
- Conductor
- Resistance
- Shunt
- Electrostatics (under Electricity)
- Condenser
- Ampere Turns
- Solenoid
- Induction
- Induced Electric Currents (under Electricity)
- Foucault Currents

(b) *Electrical Units:*

- Electrical Units

Ampere
 Volt
 Ohm
 Henry
 Farad
 Coulomb
 Watt

(c) *Electrostatic Apparatus:*

Electrophorus
 Electrical Machine
 Electroscope
 Leyden Jar (under Condenser)
 Barometric Light
 Brush
 Elmo's Fire, Saint

(d) *Measuring Instruments:*

Galvanometer
 Ammeter
 Voltmeter
 Voltmeter
 Wheatstone's Bridge
 Electrometer
 Electric Meters
 Induction Balance

(e) *Discharge in Gases or in Vacuo:*

Anode
 Discharge through Gases (under Electricity)
 Geissler's Tubes
 Crookes Tube
 X-Rays

(f) *Electric Currents:*

Galvanic Battery
 Voltaic Cell or Battery
 Dry Pile
 Storage Battery
 Dynamo Electric Machinery
 Thermo-Electricity
 Thomson Effect

3. HEAT.

Following the arrangement already specified for the study of heat, refer-

ence should be made to CALORIMETRY to ascertain how the amount of heat possessed by various bodies is measured, and to THERMOMETRY to learn how the temperature or degree of heat is determined. THERMODYNAMICS enables us to consider the relation between heat and work. See:

Heat
 Calorimetry
 Thermometry
 Diathermancy
 Regelation
 Radiation
 Thermodynamics
 Spheroidal State

Of a more practical character, are those articles involving the consideration of methods and apparatus, such as those which discuss the LIQUEFACTION OF GASES and FREEZING MIXTURES. A list of this kind would include:

Cryophorus
 Freezing Point
 Freezing-Mixtures
 Liquefaction of Gases
 Melting-Point
 Boiling-Point
 Critical Point
 Refrigeration
 Zero
 Thermometer
 Pyrometer
 Thermoscope
 Microtasmeter
 Radiation
 Radiometer
 Radiation Pressure
 Bolometer
 Hygrometer
 Safety-Lamp

4. MAGNETISM.

Complete articles on **MAGNETISM** in general and on **TERRESTRIAL MAGNETISM**, with charts, leave but little to be said in addition. The instruments used in studying magnetism, and especially the ship's compass, with its important adjustments, are also the subjects of further description. See:

- Magnetism
- Terrestrial Magnetism
- Diamagnetism
- Compass
- Declination
- Declinometer
- Dipcircle
- Inclination
- Isoclinic
- Isogonic
- Magnetometer
- Magnetic Elements
- Magnetic Equator
- Magnetic Observatory
- Armature
- Alloys, Magnetic
- Astatic Needle

5. LIGHT.

In the study of optics, there are numerous opportunities to branch off from a general treatment and carry on independent investigation in a particular field. Starting with the motion of the ether, known as light, we are able to study its **VELOCITY** and also the intensity. For the latter, photometers are employed, and the subject of **PHOTOMETRY** presents a record of many different instruments and methods. The useful application of light is included under **ILLUMINATION**. By reason of its wave motion when **DIFFRACTION** and **INTERFERENCE** take place **FRINGES** are formed, and also there re-

sults the phenomenon known as colors of thin plates. This principle of interference is the basis of one process of **COLOR PHOTOGRAPHY**; several processes are described under that title. In fact, numerous other examples could be cited, but reference to the following list will clearly indicate the extent of the range of subjects:

(a) *Light:*

- Light
- Velocity of Light
- Ether
- Diffraction and Diffraction Gratings
- Interference
- Fringes
- Colors of Thin Plates (under Light)
- Newton's Rings
- Photometry
- Reflection
- Caustic
- Refraction
- Polarization
- Prism
- Dispersion
- Color
- Complementary Colors
- Achromatism
- Rainbow
- Lens
- Foci
- Aberration, Chromatic
- Aberration, Spherical
- Spectroscopy
- Fluorescence
- Phosphorescence
- Zeeman Effect
- Mirage
- Fata Morgana

(b) *Optical Instruments:*

- Telescope
- Opera Glass

Field Glass
 Object-Glass
 Eyepiece
 Field of View
 Microscope
 Solar Microscope
 Camera Lucida
 Camera Obscura
 Aplanatic Lens
 Spectroscope
 Stereoscope
 Magic Lantern
 Moving Pictures
 Kinetoscope
 Dissolving Views
 Diaphragm
 Polariscope
 Nicol Prism
 Analyzer
 Polar Clock
 Kaleidoscope
 Chromatrope
 Zoëtrope
 Fluoroscope
 Diaphanoscope
 Cyanometer
 Dioptrimeter
 Magic Mirror of Japan

(c) *Photographic Processes:*

Photography
 Photo-Chemistry
 Negative
 Ambrotype
 Daguerreotype Process
 Copying
 Color Photography
 Photo-Engraving
 Calotype Process
 Cyanotype Process
 Ferrottype
 Fothergill Process
 Photolithography (under Li-
 thography)
 Gelatin Process

6. MATTER AND MECHANICS.

Under this head, we may include a consideration of matter, including its general properties and the theories advanced to explain it, as well as the questions concerned with the motion of matter, and the methods and units employed to measure this motion. Considering the first subdivision, it is necessary to concern ourselves with the following titles:

Matter
 Vortex
 Molecules
 Inertia
 Porosity
 Ductility
 Elasticity
 Flexure
 Viscosity
 Gases, General Properties of
 Effusion
 Cohesion
 Adhesion

The science of mechanics deals with the motion of matter. After reading the fundamental article **MECHANICS**, the reader will be prepared to appreciate the associated articles as well as those dealing with the various stages of applied mechanics. Included in the former class, are the following:

Mechanics
 Dynamics
 Kinetics
 Kinematics
 Statics
 Moment
 Momentum
 Velocity
 Acceleration
 Force
 Potential

Central Forces

Couple

Energetics

Centre of Gravity

“ “ Gyration

“ “ Inertia

“ “ Oscillation

“ “ Percussion

“ “ Pressure

Aerostatics

Aerodynamics

Pneumatics

Hydrostatics

Hydrodynamics

Vortex

Waves

Stability

Impact

Gravitation

Falling Bodies

Vector

Capillarity

Mechanical Powers

Inclined Plane

Lever

Wheel and Axle

Pulley

Pendulum

Projectiles, Motion of

In order to measure motion and its effect, there are required systems of units, and these are usually arranged on such a basis that they are parts of a symmetrical system, such as the C. G. S. (Centimeter, Gramme, Second) system. This matter is fully explained in the following articles:

C. G. S.

Mechanical Units

Dimensions

Dyne

Erg

Foot-Pound

Joule

Watt

Kilowatt

Horse-Power

For the measurement and study of matter and its motion and other properties, numerous important pieces of physical apparatus have been devised. Thus, to measure the pressure of the atmosphere, or a gas, we have the BAROMETER and the MANOMETER. To remove the air from a vessel, the AIR PUMP is applied. For the linear measures, we have scales constructed with the DIVIDING ENGINE and compared with standards on the COMPARATOR. Instruments of such nature are included in the following list:

Air Pump

Barometer

Barometer, Water

Aneroid

Manometer

Magdeburg Hemispheres

Specific Gravity

Hydrometer

Jolly Balance

Balance

Spring Balance

Weighing Machine

Torsion Balance

Weights and Measures

Metric System

Dividing Engine

Comparator

Atwood's Machine

Barker's Mill

Hero's Fountain

7. MODERN THEORIES.

Modern Physics has many recent developments to record in the field of theory and many of the ideas once considered fixed and definite have been put to the test severely under later

conditions. Even GRAVITATION, whose laws were once considered fundamental, has been considered in the light of modern thought, while the recognition of the ELECTRON and the part played by IONIZATION has modified our original idea of ELECTRICITY and the ETHER. Furthermore, we have the new conception of RELATIVITY. Whatever the existence of matter and its explanation, yet when electrical oscillations take place or material bodies emit energy, or as it is termed, RADIATION, a wide range of phenomena is produced ranging from the Electromagnetic waves used in WIRELESS TELEGRAPHY and TELEPHONY to the waves of light. When the radiations are produced by the discharge of electricity through a vacuum we have the phenomena of the X-rays, while if the radiations are furnished spontaneously, as by such radioactive elements as RADIUM, THORIUM, etc., there are afforded the varied series of phenomena that would seem to indicate transformation of one element to another and bear an important relation to the theory and explanation of matter. Accordingly, in this connection, one could read with profit the articles on:

- Ether
- Gravitation
- Relativity
- Radiation
- Radiation Pressure
- Radium
- Radioactivity
- Electricity
- Light
- X-rays
- Waves

RADIOACTIVITY, by reason of its relation to theories of matter and the

involved phenomena, both physical and chemical, is now entitled to stand as a distinct Department of Physics, in so far as the physical phenomena are concerned.

The main article on this subject deals with the theories which have been advanced to explain the many interesting phenomena of the Radioactive substances. Accordingly one should read, in addition to this article, those on the various Radioactive elements, such as:

- Radium
- Uranium
- Actinium (particularly)
- Thorium
- Polonium

The biographies of the leading workers in this field, such as the Becquerels, Sir William Crookes, Professor and Madame Curie, Ernest Rutherford, Frederick Soddy and J. J. Thomson, and others referred to in the various articles, should also be read.

8. BIOGRAPHIES OF PHYSICISTS.

Some of the greatest achievements in that branch of science which is now known as Physics have been the work of philosophers who have also accomplished much in other fields, and consequently it is impossible, particularly in the case of ancient and mediæval scientists, to term them physicists, and include them in such a list. Also, in modern times, the work of the chemist, of the engineer, of the meteorologist, of the astronomer, and of other scientific workers, closely approaches or actually transgresses the limits which the physicist has set for himself. Therefore, the following list does not include all the principal workers, but a

certain number who primarily are distinguished for their work in physics.

Abney, W. de W.
Amici, G. B.
Amontons, G.
Ampère, A. M.
Arago, D. F.
Archimedes
Atwood, George
Bache, Alex. D.
Bacon, Roger
Becquerel, A. C.
Becquerel, A. E.
Becquerel, A. H.
Bell, A. G.
Biot, Jean B.
Boyle, Robert
Brewster, Sir D.
Bunsen, R. W.
Caillietet, L. P.
Carhart, H. S.
Carnot, N. L. S.
Cavendish, H.
Chladni, E. F. F.
Clausius, R. J. E.
Coulomb, C. A.
De la Rive, A. A.
Dollond, John
Dove, H. W.
Edison, T. A.
Ewing, J. A.
Fahrenheit, G. D.
Faraday, M.
Ferrari, G.
Fleming, J. A.
Forbes, J. D.
Foucault, J. B. L.
Fraunhofer, Joseph von
Fresnel, A. J.
Galvani, L.
Gauss, K. F.
Gay-Lussac, J. L.
Geissler, H.
Gilbert, W.

Glazebrook, R. T.
Gray, Elisha
Grove, Sir W. R.
Guericke, O. von
Haidinger, W. von
Halley, E.
Hauksbee, F.
Helmholtz, H. von
Henry, Joseph
Hero of Alexandria
Herschel, Sir W.
Hertz, H.
Hittorf, J. W.
Holtz, W.
Hopkinson, J.
Huygens, C.
Jenkin, H. C. F.
Jolly, P. von
Joule, J. P.
Kater, H.
Kirchhoff, G. R.
Kohlrausch, F.
Kundt, A.
Laplace, P. S. de
Leslie, Sir J.
Lodge, Sir O. J.
Magnus, H. G.
Malus, E. L.
Mariotte, E.
Mascart, E. E. N.
Maxwell, J. C.
Mayer, A. M.
Mayer, J. R. von
Mendenhall, T. C.
Michelson, A. A.
Morse, S. F. B.
Newton, Sir Isaac
Nichols, E. L.
Oersted, H. C.
Ohm, G. S.
Ostwald, W.
Papin, D.
Pictet, R.
Plateau, J. A. F.

Pupin, M. I.	Thompson, S. P.
Quincke, G. H.	Thomson, Sir J. J.
Rankine, W. J. M.	Thomson, William (Lord Kelvin)
Rayleigh, J. W. S.	Torricelli, E.
Réaumur, R. A. F. de	Trowbridge, J.
Regnault, H. V.	Tyndall, J.
Roentgen, W. K.	Van't Hoff, J. H.
Rowland, H. A.	Violle, J.
Rühmkorff, H. D.	Volta, A.
Sabine, Sir E.	Watt, J.
Siemens, Sir W.	Weber, W.
Somerville, Mary	Wheatstone, Sir Charles
Steinheil, K. A.	Wiedemann, G.
Stevin, S.	Wilde, H.
Stokes, Sir G. G.	Woodward, R. S.
Tait, P. G.	Wroblewski, Z. F.
Tesla, N.	Young, T.

Chapter 17. Aëronautics

IN only a very recent work of reference would it be possible to assemble a number of articles dealing with the modern theory and art of aërial navigation. Indeed, the practice of aëronautics has been so affected by the great War in Europe that the military and naval aspects of the matter have become predominant, and while the mechanical features are closely connected, yet the general reader at the present time is likely to be more concerned with the use of the aëroplane and dirigible in warfare.

In the *NEW INTERNATIONAL ENCYCLOPEDIA* the student will find first a general article on *AËRONAUTICS*, in which the history of the evolution of the dirigible or airship from the balloon and of the aëroplane, from the earliest attempts at securing flight with a machine heavier than the displaced air, is traced. He will also find in the article on *GASES, GENERAL PROPERTIES OF*, the fundamental theory involved, and in the articles on *MILITARY* and *NAVAL AËRONAUTICS* the applications to warfare. In the section on *Aërial Operations*, in the long article on the *WAR IN EUROPE*, will be found a discussion of the use made of these machines in reconnaissance and combat.

The successful evolution of machines that could navigate air also has brought about legal problems and indicated changes both in international law and in other statutes or principles of law involved in the rules of the road and other obvious practices. Accordingly, a list of useful articles for one engaged in research in this field would be the following:

Aëronautics
Aërodynamics
Aërostatics
Military Aëronautics
Hangar
Navigation, Aërial, Law of
International Law

War in Europe (Section on Aërial
Operations)
Gases. General Properties of
Internal Combustion Motors
Military or Man-Raising Kite
Kite

Chapter 18. Chemistry

THE importance, for practically everybody, of acquiring a knowledge of chemistry hardly needs to be emphasized. Chemical facts and principles are involved, to a considerable extent, in every science and in every branch of industry, and chemical questions come up often in nearly every sphere of human activity.

In the *NEW INTERNATIONAL ENCYCLOPÆDIA* the science and applications of chemistry are treated in a large number of articles, many of which were written so as to serve a double purpose: first, to supply information on their special topics, without reference to chemical science as a whole, or to any other chemical topic; secondly, to form integral parts of an exposition of chemistry, for those who may desire to use the Encyclopædia for the acquisition of a general acquaintance with the subject. To serve the second purpose, they were written from a single viewpoint—on the whole, that of the German school of physical chemistry, now all but universally recognized as the best founded and most fruitful mode of viewing chemical phenomena. To serve the first purpose, which is all-important in a work of reference, each article (with few unavoidable exceptions), besides being written in simple terms, is supplied with all the information that is necessary to an understanding of the subject it treats, so that in most of the articles, no preliminary chemical knowledge is pre-supposed. But even in those articles in which the assumption of some preliminary knowledge could not, for obvious reasons, be avoided, no information was pre-supposed beyond what may be readily found in the Encyclopædia itself. Furthermore, in most of the articles the more essential information is concentrated in the opening paragraphs, the more technical and less essential in later parts of the article; so that glancing over the first paragraph alone may be sufficient for many purposes. If the end in view be the acquisition of some general knowledge of chemistry, the articles should be read entirely and carefully and the leading points briefly noted down, so as to afford, at any time of the reading, a clear retrospect over the ground covered.

For purposes of systematic reading, the chemical articles in the Encyclopædia may be grouped as follows: 1, Those dealing with general fundamental principles; 2, those dealing with the principal classes of carbon compounds; 3, those dealing with the theories of physical chemistry; 4, those articles, or sections of articles, dealing with the history of chemistry; 5, articles on the chemical elements; 6, articles on the principal compounds occurring in the living organism; 7, articles on other substances, inorganic and organic, presenting either theoretical or practical interest. In the following chapter devoted to *INTERNATIONAL CHEMISTRY*, as well as in the section on *Manufactures*, will be found listed and discussed the articles that deal with modern industrial processes and their products.

The order of this classification is the general reader, of principles and based on the relative importance, to facts. Should the course of syste-

matic reading be interrupted at some stage, a knowledge of at least some of the principles of chemistry ought to be much more valuable than a knowledge of some data concerning individual compounds, such as would be acquired if, following the usual order of chemical studies in schools, the course should be commenced by a perusal of the descriptive articles on the elements and their principal inorganic compounds.

1. FUNDAMENTAL PRINCIPLES AND PHENOMENA.

- Chemistry
- Analysis, Chemical
- Atomic Weights
- Avogadro's Rule
- Molecules
- Periodic Law
- Spectrum Analysis
- Reaction, Chemical
- Decomposition
- Dissociation
- Catalysis
- Nascent State
- Combustion
- Spontaneous Combustion

2. CARBON COMPOUNDS.

The compounds of carbon, numbering roughly 150,000, form the subject of organic chemistry, one of the most extensive and important branches of modern chemical science. In this branch the atomic and other theories have found a field for some of their most useful applications; and it is, therefore, advisable to acquire some knowledge of it at any early stage in chemical reading. The following is a list of the principal articles dealing with this branch; to be supplemented,

of course, on the practical side by those dealing with industrial processes as given in the following chapter:

- Carbon Compounds
- Stereo-Chemistry
- Alcohols
- Mercaptans
- Ethers
- Aldehydes
- Ketones
- Amines
- Amides
- Ureas
- Valence
- Carbohydrates
- Phenols
- Organo-Metallic Bodies
- Alkaloids

3. PHYSICAL CHEMISTRY.

Within recent years, physical chemistry has attained a degree of importance which makes some knowledge of it indispensable.

It is believed that this justified the introduction in the Encyclopædia of a somewhat extensive treatment of the subject. Following is a list of the principal articles, in the order in which it would seem advisable to read them:

- Avogadro's Rule
- Boiling-Point
- Freezing-Point
- Melting-Point
- Solution
- Dissociation
- Colloids
- Thermo-Chemistry
- Phase Rule
- Electro-Chemistry, General
- Photo-Chemistry
- Critical Point
- Evaporation

Distillation
Sublimation
Radioactivity

4. HISTORY OF CHEMISTRY.

The history of a great science, if studied after some knowledge of the principles and problems of the science has been acquired, has in itself a fascination for almost every mind. But, in the case of chemistry, many authorities have maintained that a knowledge of the history is not merely interesting, but absolutely indispensable to a thorough understanding of the science itself. In the *Encyclopædia*, a simple presentation of the development of chemical thought, and the gradual elimination of past errors of principle and method, will be found in the general article CHEMISTRY. Further historical information will be found in the article ALCHEMY, in the articles on physical chemistry, in those describing the elements and many chemical compounds, and especially in the biographies of celebrated chemists. Following is a list of some of the best-known names in the history of chemistry:

Helmont, J. B. van
Becher, J. J.
Stahl, G. E.
Black, J.
Priestley, J.
Cavendish, H.
Lavoisier, A. L.
Klaproth, M. H.
Dalton, J.
Wollaston, W. H.
Berzelius, J. J.
Davy, H.
Berthollet, C.
Avogadro, A.
Gay-Lussac, J. L.

Mitscherlich, E.
Liebig, J.
Wöhler, F.
Chevreul, M. E.
Dumas, J. B.
Laurent, A.
Gerhardt, K. F.
Gmelin, L.
Sainte-Claire Deville, H. E.
Cannizzaro, S.
Graham, T.
Kolbe, H.
Bunsen, R. W.
Roscoe, H. E.
Berthelot, P. E. M.
Wurtz, C. A.
Hofmann, A. W.
Regnault, H. V.
Pasteur, L.
Mendeléeff, D.
Schorlemmer, C.
Baeyer, A.
Fischer, E.
Van't Hoff, J. H.
Ostwald, W.
Nernst, W.
Arrhenius, S.
Curie, M. S. and P.
Crookes, W.
Ramsay, W.

5. THE CHEMICAL ELEMENTS.

The articles on the chemical elements will be found to contain descriptions, not only of the elements themselves, but also of their principal compounds, so that each article forms a chapter of inorganic chemistry. Following is a list of some of the principal articles in a recognized order of arrangement:

Hydrogen
Oxygen
Nitrogen
Carbon

Chlorine
 Bromine
 Iodine
 Fluorine
 Sodium
 Potassium
 Lithium
 Magnesium
 Calcium
 Strontium
 Barium
 Zinc
 Cadmium
 Mercury
 Boron
 Aluminium
 Silicon
 Tin
 Lead
 Zirconium
 Thorium
 Phosphorus
 Arsenic
 Antimony
 Bismuth
 Sulphur
 Selenium
 Tellurium
 Chromium
 Molybdenum
 Tungsten
 Uranium
 Manganese
 Iron
 Cobalt
 Nickel
 Platinum
 Palladium
 Copper
 Silver
 Gold

Articles on the rest of the elements, including the rare gases ARGON, HELIUM, NEON, KRYPTON, and XENON,

and of the radioactive elements, including RADIUM, POLONIUM, ACTINIUM, and THORIUM, will be found in their proper places. In connection with the radioactive elements, reference should be made to the article on RADIOACTIVITY. A list of the elements, with their chemical symbols and atomic weights, will be found in the article ATOMIC WEIGHTS.

6. COMPOUNDS OCCURRING IN LIVING ORGANISMS.

Physiological chemistry deals with the individual compounds forming the chemical ingredients of the materials of which living organisms and their products (*e. g.*, milk) are made up. A knowledge of the chemical and physical properties of those compounds is indispensable in the study of chemical physiology, and hence of physiology in general. The following is a list of the more important physiological compounds described under their names in the Encyclopædia:

Albumen
 Allantoïn
 Carbohydrates
 Cellulose
 Carnin
 Casein
 Cerebrin
 Chitin
 Cystin
 Elastin
 Fats
 Fibrin
 Gelatin
 Globulins
 Glycogen
 Guanin
 Hypoxanthin
 Keratin

Kreatin
Kreatinin
Legumin
Leucin
Ossein
Proteins
Starch
Syntonin
Taurin
Urea
Uric Acid
Hæmatin
Hæmoglobin

Trimethylamine
Aniline
Pyridine
Quinoline
Alkaloids
Ptomaines

The article **ALKALOIDS** contains a list of the important members of this class of substances, with their principal characteristics. More extensive descriptions are given in the special articles on all the more important alkaloids.

**7. OTHER IMPORTANT ARTICLES ON
CHEMICAL SUBJECTS.**

(a) *Metallic Alloys:*

Alloy
Amalgam
Babbitt Metal
Brass
Britannia Metal
Bronze
Fusible Metal
German Silver
Phosphor-Bronze
Pewter
Pinchbeck
Platiniridium
Spence's Metal

(b) *Bases:*

The inorganic bases, *i. e.*, metallic oxides and hydroxides, are mostly described in connection with the metallic elements. Important special articles are:

Ammonia
Lime
Soda

The articles on organic bases include:

Amines
Ethylamine

(c) *Acids:*

All the more important acids are described in special articles under their names. Many acids of secondary importance are mentioned in connection with their characteristic elements. Following is a partial list of important articles on acids:

i. General:

Acids
Phenols

ii. Inorganic:

Sulphuric Acid
Hydrochloric Acid
Nitric Acid
Sulphureted Hydroger
Phosphoric Acid
Hydrobromic Acid
Hydriodic Acid
Hydrofluoric Acid
Chloric Acid
Perchloric Acid
Hypochlorous Acid
Nitrous Acid
Hyponitrous Acid
Phosphorous Acid
Hypophosphorous Acid
Manganic and Permanganic
Acids

iii. Organic:

Acetic Acid
 Benzoic Acid
 Butyric Acid
 Caproic, Caprylic, and Capric
 Acids
 Carbolie Acid
 Carbonic-Acid Gas
 Cinnamic Acid
 Citric Acid
 Cyanic Acid
 Cyanuric Acid
 Formic Acid
 Fumaric and Maleic Acids
 Gallic Acid
 Glycin
 Hippuric Acid
 Hydrocyanic Acid
 Hydroferricyanic Acid
 Hydroferrocyanic Acid
 Lactic Acid
 Lauric Acid
 Malic Acid
 Margaric Acid
 Meconic Acid
 Myristic Acid
 Œnanthylic Acid
 Oleic Acid
 Oxalic Acid
 Palmitic Acid
 Picric Acid
 Stearic Acid
 Succinic Acid
 Tannic Acid
 Tartaric Acid
 Uric Acid
 Valeric Acid

An important "homologous series" of acids, included in this list, is constituted by the following so-called "fatty acids":

Formic
 Acetic

Butyric
 Valeric
 Caproic
 Caprylic
 Capric
 Senanthylic
 Lauric
 Myristic
 Palmitic
 Margaric
 Stearic

Allied to the last-named is Oleic Acid.

The acid anhydrides are mostly mentioned in connection with the metalloid elements.

(d) Salts:

Salts are mostly described in connection with either the acids or the bases combined in them. The following are a few special articles on salts:

Alum
 Borax
 Cream of Tartar
 Epsom Salt
 Glauber's Salt
 Iodides
 Rochelle Salt
 Ichthyol
 Saltpetre
 Soda

Bases, acids, and salts constitute together the so-called "electrolytes." Their peculiar behavior in aqueous solutions has led to the formulation of the now well-known theory of electrolytic dissociation, which may be found treated in the articles SOLUTION, DISSOCIATION, and ACIDS.

(e) Hydrocarbons:

Hydrocarbons
 Methane

Ethane
Propane
Butane and Isobutane
Ethylene
Acetylene
Benzene
Naphthalene
Anthracene

Further information concerning hydrocarbons may be found in articles on such products as oils (volatile), paraffin, ozokerite, petroleum, benzine, rubber, gutta-percha, gas (illuminating and natural), etc.

(f) Other important compounds:

Water
Hydrogen Dioxide
Ozone
Alcohol
Methyl Alcohol
Glycerin
Mannite
Aldehyde
Chloral
Acetone
Almonds, Volatile Oil of
Acrolein
Acetone
Ether
Chloroform
Iodoform
Nitro-Benzene
Carbides
Calcium Carbide
Carbon Disulphide
Carbonic Oxide
Cyanogen

(g) Pigments, Dyestuffs, and Allied Subjects:

Paints
Mineral Colors
Vegetable Colors

Dyeing
Mordants
Coal-Tar Colors
Tar
Coal Tar
Indigo
Alizarin
Purpurin
Aurin
Rosolic Acid
Archil
Arnotto
Carmine
Cochineal
Flavin
Fustic
Henna
Indian Yellow
Lac Dye (under Lac)
Litmus
Madder
Orcin
Orcein
Logwood
Murexid
Phenicin
Quercitron
Green
Brunswick Green
Turkey Red
Cinnabar
Blue
Indigo
Lampblack
White Lead

A list of the widely used coal-tar colors ("aniline dye-stuffs"), with their principal characteristics, will be found in the article COAL-TAR COLORS.

(h) Waxes, Fats, Oils, and Soap:

Waxes
Beeswax
Spermaceti

Fats
 Palmitin
 Stearin
 Olein
 Oils
 Almonds, Expressed Oil of
 Almonds, Volatile Oil of
 Canada Balsam
 Castor Oil
 Cod-Liver Oil
 Croton Oil
 Garlic, Oil of
 Grass-Oil
 Gurjun Balsam
 Lemon Oil
 Menthol
 Petroleum
 Turpentine
 Wintergreen, Oil of
 Soap

All the typical waxes and oils are described in the general articles under these names. Paraffin, which is sometimes spoken of as "paraffin wax," is described in an article under its own name.

(i) *Gums and Resins:*

Gums
 Resins
 Amber
 Ammoniac
 Anime
 Arabin
 Copal
 Bassora Gum
 Bdelium
 Catechu
 Dragon's Blood
 Gambir
 Gamboge
 Gum Arabic (under Gums)
 Kino
 Mucilage

Olibanum
 Podophyllin
 Rosin
 Sandarac
 Scammony

Camphor, which is sometimes spoken of as "gum camphor," is described under its own name. "British gum," a substitute for gum arabic, is described under DEXTRIN.

(j) *Explosives:*

The chemistry of EXPLOSIVES, both those employed for military purposes and in mining and other industries, represents a field in which the theoretical and technological advances have been extraordinary, and the new compounds that the chemist has invented have played their part in peace and war. In no department of chemistry have there been more interesting developments than in the theory of Explosives and the various groups into which modern Explosives are classified all present interesting theoretical considerations for the chemist.

Accordingly, the student interested in the history, classification and theory of Explosives, and wishing to learn of the various explosive mixtures, of the nitrates, of the chlorates and perchlorates, and compounds derived by nitro-substitution, and those compounds known as nitro-derivatives, as well as smokeless powders, nitroglycerin, fulminates and amides, should read the article on EXPLOSIVES, which not only discusses theory, but the growth of the industry in the United States and the use of Explosives in industry, such as for blasting and mining, and the regulations attending their transportation and stor-

age. Of course, the older forms of Explosives are discussed under gunpowder, while GUNCOTTON, NITRO-GLYCERIN and NITRO-CELLULOSE show the application of these substances to this branch of chemistry. *Dynamite* is typical of the articles on high power explosives, while the article on TRINITROTOLUENES describes one of the latest of the powerful military explosives.

An appropriate list for careful reading in this department would be as follows:

Dualine
Dynamite
Extralite
Explosives
Emmensite
Nitroglycerin

Guncotton
Gunpowder
Melinite
Lyddite
Magazine
Nitrocellulose
Pyroxylin
Stemming
Trinitrotoluenes

(k) *Waters:*

Water
Ice
Distilled Water
Aërated Waters
Carbonated or Acidulous Waters
Chalybeate Waters
Mineral Waters
Selters Water
Apollinaris Water

Many of the foregoing articles are concerned either with theory or with the nature and composition of various chemical elements or substances, apart from their uses in the arts, where the labors of modern research chemists have found wide and useful application. Accordingly, the following chapter on INDUSTRIAL CHEMISTRY will take up some of the more important substances and processes that enter into modern technology.

Chapter 19. Industrial Chemistry

HAVING mastered the underlying principles and more important facts of chemistry, such as the nature of the various elements, the conditions under which they exist and the laws under which they combine, and the most generally and commonly employed chemical substances, the reader interested in the practical applications of this vast field of theoretical science naturally will desire information as to the extent to which scientific chemistry figures in the arts, and some description of the various technological processes involved in wholesale production. Methods of manufacture representing theory reduced to practice often involve the results of the most refined research and scientific investigation, by which everyday materials are produced for general use and the benefit of mankind. Vast industries involving both inorganic and organic chemistry have been built up on the labors of the scientist, and as trade follows the flag so manufacturing prosperity follows and in large measure depends on the labors of the industrial chemist.

The reader of this department in *THE NEW INTERNATIONAL ENCYCLOPEDIA*, who first has studied the leading articles of the last chapter, probably would be best served by taking up first the articles dealing with the various processes of industrial chemistry, noting especially how the methods of the factory differ from those of the laboratory.

Leading articles in this field would be:

Lixiviation
Evaporation
Distillation
Sublimation
Filter and Filtration
Filter Press
Bleaching
Calcining
Refrigeration
Roasting
Electro-Chemistry

FUEL.

Then, as heat plays an important part in all industry, chemical and other, a study of fuels would be next in order. Fundamentally and generally these are discussed in the article on *FUEL*. There are articles on the various solid and liquid fuels to which reference should be made for the im-

portant by-products involved, as in the case of the coal-tar colors, ammonia, hydrocarbons and other substances from the coal gas plants and coke ovens. These represent quite an important field of chemistry. Therefore, it may be suggested that the articles be taken up as follows:

Solid Fuels:

Charcoal
Coal
Anthracite
Bituminous Coal
Tar
Lignite
Coal Tar
Coke
Peat

Liquid Fuels:

Alcohol

Petroleum
Kerosene
Oil

Gaseous Fuels:

Gas, Illuminating and Fuel
Acetylene
Calcium Carbide
Gas Engine
Internal Combustion Engine
Motor Vehicle

WATER.

The Industrial Chemist after fuel is next concerned with Water. It may be hard or soft, saline or alkaline, suitable or unsuitable for use in a boiler, or having special properties making it desirable in the manufacture of such beverages as beer and ale. Its purification may require a wide range of special processes ranging from chlorination to distillation. Accordingly, a suitable line of reading would be somewhat as follows:

Water
Water Supply
Water Purification
Water Works
Distillation
Filter and Filtration
Boiler
Boiling Point
Mineral Waters
Bottling

COMMON CHEMICALS.

In Industrial Chemistry there are a number of rather common chemicals, but with a vast economic importance, for they enter so largely into manufacturing that they are always in constant demand and use. A few of these groups may be studied at some length. Thus—Sulphur, whose mining, extrac-

tion and purification are all problems in chemical engineering, has a number of important compounds, of which the best known industrially are found in the accompanying list:

Sulphur
Sulphureted Hydrogen
Sulphuric Acid
Sulphurous Acid
Thiosulphuric Acid

Found widely in nature, SALT is an important substance and common salt or Sodium Chloride is used not only for food, but in the manufacture of Soda Ash, Sodium Carbonate, and other substances. Consequently, the articles

Sodium
Salt
Soda

should be read, it being noted that under these a number of Sodium compounds are treated.

The Chlorine industry involves the preparation of substances used extensively in the arts as a bleaching or oxidizing agent, and the liquid chlorine in addition has been employed extensively as an asphyxiant in the great European War. See:

Chlorine
Chloric Acid
Chlorites
Chlorimetry
Hydrochloric Acid
Hypochlorous Acid
Sal Ammoniac
Mercuric Chloride
Mercurous Chloride
Bleaching Powder
Chloridizing
Chlorination

The various compounds of calcium supply to the arts a large number of important materials, including **MARBLE** and other **BUILDING STONES**, **LIME-STONE** for iron and lead smelting, **GYPNUM OR PLASTER OF PARIS** (Lime Sulphate), **CEMENT**, in which Lime is the principal ingredient, **BLEACHING POWDER** or **CHLORIDE OF LIME**, **MORTAR**, in which Lime enters largely, and so on through an extensive list. In practically all of these purposes there is work for the industrial chemist, whether it involves the calcining of the material in a kiln to form cement or the study of concrete, now used so largely for structural work. Consequently, the reader who follows through the various articles on Calcium and its compounds as given below will realize their industrial importance:

- Lime
- Limestone
- Marble
- Building Stone
- Marl
- Chalk
- Calcite
- Iceland Spar
- Gypsum (Lime Sulphate)
- Bleaching Powder (Lime Chloride)
- Cement
- Kiln
- Mortar
- Concrete
- Masonry
- Plaster of Paris
- Plaster, Lathing and Plastering
- Calcium Carbide
- Fertilizers
- Manures and Manuring
- Iron and Steel, Metallurgy of
- The Destructive Distillation of wood

affords a number of important products, among which is acetic acid, largely used in the manufacture of acetates. There are also a number of other or related substances, so that if we examine a rather broad group we find a number of valuable materials included. These may be embraced in the following list:

- Distillation
- Acetic Acid
- Acetine
- Methyl Alcohol
- Tar

The Destructive Distillation and other treatment of bones also affords useful chemical products. The use of bone products as fertilizers, the employment of bone black as a decolorizing agent in filtration, as in sugar refining, are specially important. The connection tissue in skin and bones is used in making gelatine, and the bones themselves are employed in making glue. Accordingly, if the articles enumerated below be consulted a substantial idea of this field of chemical technology will be gained:

- Bone
- Bone Black
- Bone Fertilizers
- Gelatin
- Glue

The industrial chemist has important work in connection with the manufacture of various artificial fertilizers which modern intensive agriculture demands. Naturally, this branch is closely connected with scientific agriculture and agricultural chemistry. Consequently, one will find in the accompanying list of articles much that will indicate how the chemist is assist-

ing the processes of nature. Such articles would be:

Manures and Manuring
Bone Fertilizers
Peat
Ashes
Phosphate
Potash
Kelp
Cyanamid

INORGANIC INDUSTRIES.

In Industrial Chemistry the great division of inorganic and organic chemistry can be observed in considering the products of various industries. A certain number containing various groups have been entered specifically on these lists, but the main topics involved can be indicated together and then the reader can pursue his investigations further, depending both on the list in this Guide and on the elaborate cross references given with the articles. Under Inorganic Chemistry reference profitably can be made to the following main and more prominent articles:

Sulphur
Sulphuric Acid
Salt
Hydrochloric Acid
Soda
Sodium
Chlorine
Nitric Acid
Ammonia
Potash
Bromide
Iodine
Phosphorous
Boric Acid
Arsenic
Oxygen

Peroxides
Sulphates
Alum
Cyanides
Carbon
Carbon Disulphide
Carbon Monoxide

MINERAL COLORS.

An important series of industries in Inorganic Chemistry involve the manufacture of pigments. The various chemicals entering into the more important of the pigments are discussed largely under MINERAL COLORS and separately as follows:

White:

White Lead
White Chalk
Lithopone
Gypsum
China Clay

Blue:

Ultramarine
Smaltite
Copper Indigo

Green:

Ultramarine
Brunswick Green
Chrome Green
Malachite Green
Verdigris
Paris Green

Yellow:

Chrome Yellows
Cadmium
Litharge
Gamboge
Indian Yellow or Purree

Orange:

Chrome Orange

Red:

Red Lead
 Chrome Red
 Red Ochre
 Vermilion
 Realgar
 Antimony Red
 Carmine

Brown:

Umber
 Sepia

Black:

Lampblack
 Bone Black
 Charcoal
 Graphite

ORGANIC INDUSTRIES.

Industrial Chemistry is so closely connected with manufacturing and manufacturing processes that in any classification such as could be observed in an encyclopædia, it is very difficult to draw any satisfactory line of demarkation. Particularly is this the case in the large number of industries where organic chemistry plays an important part and underlies the various processes of manufacture.

Accordingly, the reader should refer to the chapter on MANUFACTURES AND ENGINEERING, where, under these various industries and products often the chemical technology is discussed. Such a list of organic industries would be as follows:

Distillation
 Gas, Illuminating and Fuel
 Coal Tar
 Coal-Tar Colors
 Mineral Oils

Petroleum

Waxes
 Fats
 Oils
 Soap
 Candle
 Glycerine
 Gums
 Resins
 Starch
 Dextrin
 Glucose
 Sugar
 Fermentation
 Distilled Liquors
 Beer
 Brewing
 Explosives
 Fibres
 Dyeing
 Paper
 Leather
 Glue

MINERAL OILS.

The preparation and refining of Mineral Oils has produced a wealth of materials aside from the fuel oils proper, and one interested in this field after reading the comprehensive discussion on PETROLEUM will turn to other articles dealing with allied topics, as contained in the accompanying list:

Petroleum
 Naphtha
 Paraffin
 Petrolatum
 Vaseline
 Shale Oil
 Ozokerite
 Mineral Tallow
 Asphalt

Chapter 20. Home Economics and Domestic Science

IT is but natural that the modern tendency to secure increased efficiency and, consequently, increased comfort and convenience should be manifested in the home through the application of scientific management and devices no less than in commerce and industry. In its latest aspects this finds full expression in the *NEW INTERNATIONAL ENCYCLOPEDIA*.

Modern science has done much for the housekeeper, securing more nourishing and more economical foods, as well as as various labor-saving devices—such as *SEWING MACHINES* and *VACUUM CLEANERS*—that materially cut down the effort necessary to maintain and operate a domestic establishment. This concerns the small as well as the large householder, for electric light, gas heating and plumbing are all but universally found, and economic methods have been devised for the small city apartment or the isolated farm whereby the maximum well-being, comfort and economies generally can be obtained.

Modern *home economics* is not concerned alone with Food and its Preparation. The intelligent woman of to-day, managing a home, often arranges for its building, for the carpentry, heating, plumbing, wall paper, furniture and carpets and rugs, or for its lease if a rented dwelling, or a portion of an apartment house or hotel. If sufficiently large, the dwelling may involve electric heating, including electric cooking, vacuum cleaners or laundry machines, and in many of the modern homes may involve an organization as complex as a small business, and this involves a number of employees—male and female—to whom the principles of Master and Servant must apply. In a large part, however, Domestic Science has to do with food and its preparation, for it is here that the chemistry of nutrition has been brought to bear, and the wholesome and economical preparation of food is one of the main objects of the modern science of Household Chemistry.

Considering, therefore, the articles already suggested and others arranged in a convenient list for ready reference, we should have first the following, dealing with the home and its material equipment:

House
Apartment House
Tenement House
Hotel
Building
Carpentry
Heating and Ventilation
Plumbing
Electric Heater
Electric Lighting
Lighting

Illumination
Vacuum Cleaner
Water Supply
Filter and Filtration
Laundry Machinery
Sewage Disposai

On the legal side, the householder should know something of the law dealing with such subjects as:

Deed

Title
Lease
Master and Servant

Supplied with a proper house and concerned with its management or with the management of an institution where features of home life and home conveniences must apply, one would be concerned with the articles on

Home Economics
Management, Home and Institution
Coöperation
Marketing Associations, Agricultural

It is, however, on food and food supply that intelligent interest centers, for it is here that the high cost of living first makes itself apparent, not to mention that the appetite may prove the shortest road to a man's well being if not to his mind. One concerned with modern scientific food studies realizes that chemistry and physiology figure actively, so that a range of articles are available that are indeed comprehensive.

Food
Fish as Food
Diet
Digestion
Nutrition
Infants, Feeding of
Cookery
Baking
Baking Powder
Fireless Cooker
Food Preservation

Sterilized Food
Packing Industry
Slaughterhouse
Adulteration
Pure-Food Law

Prepared by the preceding rather general articles on Foods and Food-Stuff, the reader in this department will be ready to take up specifically a number of classes of Foods, or, in some cases, definite food substances. Such a list would include the grains and their products:

Barley
Buckwheat
Rye
Wheat
Maize
Rice
Flour
Bread

There would also be such important foods as

Milk
Cream
Butter
Butter Color
Butter Making
Oleomargarine
Cheese
Eggs
Meat
Meat Extract
Nuts
Fruits
Vegetables

Chapter 21. Interior Decoration and Decorative Art

WITHIN a few years there has developed in connection with, yet at the same time apart from, architecture and the fine arts increased interest in those æsthetic forms of expression that are found in the home or dwelling. While always recognized on its artistic side, home decoration has now become a practical art requiring systematic training on the part of those by whom it is practised, and having secured for itself general public recognition as distinct from architecture or mere trade activity in the supply of the articles necessary for the home.

With the growth of civilization the decoration of the home, be it a hut, cave, cottage, or palace, has always appealed directly to its owner or occupants, and their taste has found expression in combining beauty with utility. As a result there is to be seen decorative activity ranging from a most humble scale to securing the work of the greatest artists of the period for ornamental purposes. It is only recently that the proper and most advantageous uses of articles of decorative value have been recognized, and with the growth of luxury and comfort there has been, on the whole, a corresponding growth in good taste. In large part, this has been due either to artist, craftsmen of rare talents or to those who have studied the various æsthetic elements involved in house decoration, recognizing the cardinal principle that a home is designed for habitability. From such study encouraged by museums and collections there has grown up a school of decorative art known as interior decoration, which aims to cultivate public taste to appreciate the artistic and to make the home conform to the accepted canons of good taste, where the work not only of artists but of skilful craftsmen and artisans will be appreciated.

This movement involves both a general manifestation of progressively better taste and the activities of those trained professionally in schools of fine arts or design to practice the art of interior decoration and to advise persons who need such assistance. Just as the ordinary person requires the service of an architect to design or remodel a house or apartment, so when its decoration and furnishing are involved there is no less a call for the services of a trained interior decorator, rather than a mere painter, upholsterer or tradesman. To this profession many women, as well as men, are now devoting themselves with marked success, and to learn of their training and their work one can turn to the article on INTERIOR DECORATION. Here will be found, also, a broad view of the development and scope of the modern art, and if read in connection with the more formal article on DECORATIVE ART, with attention also to ORNAMENT and ARCHITECTURE, a good idea will be gained of the modern status of this important field. Naturally, there are subsidiary to it a number of subordinate articles—thus, FURNITURE is an important part of Interior Decoration, and in its development may be traced the

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general progress of the beautiful with the practical, though retrogression in taste unquestionably is to be noted with the increase of mechanical facility in production and otherwise. Likewise, in CARPETS and RUGS decorative impulse finds expression, and floor coverings represent a wide diversity of artistic ideas, depending upon their service, from the hand looms of the Orient to the modern carpet factory. Again, in the decoration of the surfaces of walls from the older tapestries to the WALL PAPER of the day, a distinct artistic development is represented. In TEXTILE PRINTING also modern art has brought about a wide range of decorative material for the modest householder.

Therefore, with the citation of such main titles, a consideration of a somewhat fuller list will show the interrelation of the articles in this and allied departments, and how advantageously they fit into a comprehensive reading scheme. The list might be taken up in the following order:

Interior Decoration	Veneer
Decorative Art	Wall Paper
Ornament	Paper Hanging
Architecture	Textile Printing
Mural Decoration	Tapestry
Painting	Gobelin
Sculpture	Carpet
Illumination	Rug
Furniture	Lamp
Chippendale Chairs	Lacquer Work
Chippendale, Thomas	Pottery
Hepplewhite, George	Armor
Sheraton, Thomas	Metal Work
Boulle	

Chapter 18. Geology

GEOLGY covers a broad field. Its primary object is to explain the origin and development of the earth and the inhabiting life forms. It is concerned thus on the one side with inorganic nature—the character of the materials which constitute the earth's structure, the formation and classification of rocks, the forces of uplift that have produced mountains and continental lands, the agencies that work to modify surface features, the phenomena of earthquakes and volcanoes, and all processes of change operative from the beginning; in another aspect it is allied to the biologic sciences for which it endeavors to find an explanation for the present distribution of plants and animals in the evidences afforded by fossils which have been preserved in the superficial layers of the earth.

Because of its wide scope, geological science has been separated into a number of departments, each with its distinct formations, but none the less closely related to all the others. Of fundamental importance is Petrology, the branch which considers the nature of rocks and the methods of their origin. This branch is one of the last to have attained a real scientific basis. The arrangement of the rocks as they appear at the surface—often quite different from their original attitudes—and the significance of the arrangement in relation to past events, constitute the subject matter of Structural Geology. The great changes which have taken place and are still in progress belong to the field of Dynamical Geology, which considers the action of the atmosphere, water, igneous activity and crustal strains in modifying the earth's features. Its study is essential to the proper understanding of physical geography, particularly the modern development of that subject known as physiography. Consequently the references to physiographic articles will be included under its head. Stratigraphical Geology has for its particular province the investigations of the order and chronological classification of the strata and the study of the geography of the earth in past ages. It has a valuable adjunct in Paleontology, which is the study of fossils and their interpretation in the light of evolution. Geology has many practical bearings, and its application to mining, agriculture and engineering is considered under the head of Economic Geology.

We shall now guide the reader to the articles relating to those several divisions of the subject. For the general article, see GEOLOGY.

A. Petrology

For the more comprehensive articles in this field, see:

Petrology
Mineralogy

Crystallography
Rock

The various large groups or classes of rocks are described under the following titles:

Igneous Rocks
 Aqueous Rocks
 Æolian Accumulations
 Clastic Rocks
 Plutonic Rocks
 Metamorphic Rocks
 Crystalline Rocks
 Arenaceous Rocks
 Argillaceous Rocks
 Calcareous Rocks

For the more important specific kinds of rocks, see:

1. IGNEOUS (MASSIVE) ROCKS:

Granite
 Rhyolite
 Porphyry
 Syenite
 Trachyte
 Phonolite
 Diorite
 Dacite
 Felsite
 Gabbro
 Pyroxenite
 Hornblendite
 Peridotite
 Diabase
 Basalt
 Melaphyre
 Felsite
 Trap
 Obsidian
 Pitchstone
 Lava
 Tuff

2. SEDIMENTARY (STRATIFIED) ROCKS.

(a) Mechanical Sediments:

Sand
 Gravel
 Sandstone

Conglomerate
 Breccia
 Clay
 Shale
 Silt
 Loess
 Boulder Clay
 Drift

(b) Chemical Sediments:

Limestone
 Dolomite
 Travertine
 Gypsum
 Salt
 Geyserite
 Bog-Iron Ore
 Clay Ironstone

(c) Organic Sediments:

Limestone
 Coquina
 Chalk
 Coral
 Marl
 Diatomaceous Earth
 Phosphate Rock
 Peat
 Lignite
 Coal

3. METAMORPHIC (FOLIATED) ROCKS:

Marble
 Quartzite
 Slate
 Schist
 Gneiss
 Amphibolite
 Mica Schist
 Eclogite
 Serpentine
 Talc
 Soapstone
 Chlorite Schist

B. Structural Geology

The broader features of geological structure are described in the articles:

Bed
Formation
Conformity
Unconformity
Laccolite
Batholite
Boss
Dike
Sill
Veins

The smaller elements of structure which pertain to the above larger forms are explained in the articles:

Joints

Foliation
Lamination
Schistosity
Stratification

The effects of uplift and disturbance upon rocks are described in the articles:

Continent
Mountain
Anticline
Syncline
Monocline
Dip
Strike
Fault
Clinometer

C. Dynamic Geology and Physiography

The general subject of dynamic agencies operative within the earth is discussed in the articles:

Crust of the Earth
Elevation and Subsidence
Metamorphism
Cataclysm
Volcano
Earthquake
Geyser
Refrigeration of the Earth

For the evolution of the topography of the earth's surface, see:

Physiography
Erosion
Continent
Island
River
Valley
Plateau
Lake
Glacier
Glacial Period

D. Stratigraphical Geology

The rocks composing the outer solid structure of the earth are separated according to their position and relative age into large divisions which are

designated as groups. Each group represents a long interval of time or era during which the strata were accumulated. The different groups and

their corresponding eras are described under:

Archeozoic Era
Proterozoic Era
Paleozoic
Mesozoic Era
Cenozoic

These main divisions are further subdivided into systems, or, according to the time element, into periods. The several systems are described in the following articles:

1. *Archeozoic and Proterozoic:*

Pre-Cambrian Formations

2. *Paleozoic:*

Cambrian System
Ordovician
Silurian System
Devonian System
Carboniferous System
Permian System

3. *Mesozoic:*

Triassic System
Jurassic System
Cretaceous System

4. *Cenozoic:*

Tertiary System
Quaternary System

The broader scheme of classification as outlined above is of general application. Further subdivision becomes necessary in the study of particular areas, for the individual strata change in character and often in fossil content, as they are traced from place to place. To identify the minor units, geologists usually employ local names

which have currency only within a single country or among such countries as have very similar stratigraphic development. Some of the more important minor divisions in the United States are described in the articles:

Pre-Cambrian:

Keweenaw Series

Cambrian:

Potsdam Sandstone

Ordovician:

Calcareous
Trenton
Hudson River Beds

Silurian:

Medina Series
Clinton Stage
Niagara Series
Salina Stage

Devonian:

Oriskany
Lower Helderberg
Chemung Formation
Catskill Formation

Carboniferous:

Millstone Grit
Pottsville Conglomerate
Burlington Limestone

Triassic:

Newark Series

Jurassic:

Liassic
Oolite

Cretaceous:

Potomac Formation
Dakota Stage
Niobrara Stage
Laramie Stage

Tertiary:

Eocene Epoch
Oligocene Epoch
Miocene Epoch
Pliocene Epoch

Quaternary:

Columbia Series
Drift
Glacial Period
Recent Period

E. Paleontological Geology

Paleontology is the study of the nature and distribution of the life forms imbedded in the rocks of the earth's crust. Viewed from the standpoint of biological science, it is a part of zoology and botany; but it is so intimately connected with the study of the rocks themselves that it may properly be considered a part of geology. The general articles on the subject are:

Paleontology
Paleobotany
Fossil
Fossiliferous Rocks
Contemporaneity
Homotaxy
Ichnology
Fossil Forests

From a biological point of view, the proper method of classifying fossil forms would naturally follow the same principles that guide the classification of living plants and animals. But in studying paleontology as a part of geology, the geological classification is preferable; indeed, the two systems would, to a certain extent, coincide. We shall, therefore, refer the reader to the characteristic fossils of each geological epoch. Most of the larger classes and orders of fossil forms are still represented by living species, and general discussions of these classes

will be found in the articles given in the chapters on Botany and Zoology.

1. The only fossils found in the Pre-Cambrian Formation are described in the article **ANTIPOKANIA**:

2. CAMBRIAN FOSSILS:

(a) *Plants*:

Oldhamia

(b) *Animals*:

Protospongia
Dictyonema
Agnostus
Paradoxides
Dikellocephalus
Olenellus
Trilobita
Lingula
Obolella
Hyolithes
Nautiloidea

3. ORDOVICIAN AND SILURIAN FOSSILS:

(a) *Invertebrates*:

Brachiospongia
Stromatopora
Graptolite
Monograptus
Favosites
Olenus
Chonetes
Asaphus
Polyzoa

Fenestella
 Atrypa
 Orthis
 Spirifer
 Pentamerus
 Bellerophon
 Pteropoda
 Orthoceras
 Tentaculites
 Eurypterus

(b) *Fishes:*

Pteraspis
 Cyathaspis

4. DEVONIAN FOSSILS:

(a) *Invertebrates:*

Atrypa
 Cyathophyllum
 Phacops
 Ammonoidea
 Pleurotomaria
 Murchisonia
 Clymenia
 Goniatites
 Bactrites
 Heliophyllum

(b) *Fishes:*

Holoptychius
 Osteolepis
 Dipterus
 Coccosteus
 Dinichthys
 Cephalaspis
 Chirolepis

5. CARBONIFEROUS FOSSILS:

(a) *Plants:*

Neuropteris
 Calamites
 Asterophyllites
 Annularia

Lepidodendron
 Sigillaria
 Stigmaria
 Cordaites
 Carpolith
 Trigonocarpus

(b) *Invertebrates:*

Fusulina
 Chonetes
 Productus
 Proetus
 Eurypterus

(c) *Fishes:*

Megalichthys
 Cestraciont

(d) *Reptiles:*

Stegocephalia

6. PERMIAN FOSSILS:

(a) *Fishes:*

Palæoniscus

(b) *Reptiles:*

Rhynchocephalia

7. TRIASSIC FOSSILS:

(a) *Plants:*

Equisetum
 Cycadaceæ

(b) *Invertebrates:*

Terebratula
 Ceratites
 Ammonites

(c) *Reptiles:*

Mastodonsaurus
 Theromorpha
 Dinosauria
 Anchisaurus
 Labyrinthodon
 Dicynodon

- (d) *Mammals:*
Microlestes
Microconodon
8. JURASSIC FOSSILS:
(a) *Invertebrates:*
Gryphæa
Trigonia
Belemnites
(b) *Fishes:*
Chondrosteus
Hybodus
(c) *Reptiles:*
Teleosaurus
Ichthyosaurus
Plesiosaurus
Pterodactyl
Dimorphodon
Diplodocus
Megalosaurus
Brontosaurus
Stegosaurus
Titanosaurus
Cynognathus
Baptanodon
Camptosaurus
Ceratosaurus
(d) *Birds:*
Archæopteryx
(e) *Mammals:*
Ctenacodon
9. CRETACEOUS FOSSILS:
(a) *Invertebrates:*
Foraminifera
Globigerina
Ventriculites
Hippurites
Radiolites
Inoceramus
(b) *Reptiles:*
Chelonia
(c) *Birds:*
Iguanodon
Mosasauria
Elasmosaurus
Hadrosaurus
(c) *Birds:*
Bird, Fossil
Hesperornis
Ichthyornis
10. EOCENE FOSSILS:
(a) *Invertebrates:*
Nummulites
(b) *Reptiles:*
Zeuglodon
(c) *Mammals:*
Coryphodon
Hyracotherium
Horse, Fossil
Palæotherium
Anchitherium
Anoplotherium
Lophiodon
Creodonta
11. MIOCENE FOSSILS:
(a) *Mammals:*
Mastodon
Dinotherium
Helladotherium
Machærodus
Elotherium
Halitherium
Hyracodon
Oreodon
Titanotherium
12. PLIOCENE FOSSILS:
(a) *Plant:*
Dæmonelix
(b) *Mammals:*
Sivatherium

Hipparion
Sabre-Toothed Tiger

13. QUATERNARY FOSSILS:

(a) *Birds*:
Æpyornis
Moa

(b) *Mammals*:
Elasmotherium
Megatherium
Glyptodon
Diprotodon
Mammoth
Mastodon
Pithecanthropus

F. Economic Geology

This department considers the application of geological facts and principles to industry and technology. The service of geology to mining is especially important and has been recognized very generally by the organization of public surveys to furnish information about the occurrence and distribution of the mineral resources. With this function is usually combined the study of underground waters, a branch that has gained prominence quite recently through the development of the arid tracts of the western United States. Geology also affords useful guidance in the conduct of engineering construction, and of course is the basis for the investigation of the formation and distribution of soils.

The mineral materials that find employment in the arts or industry are of great variety and exhibit wide differences in their methods of occurrence. Some are used in the form in which they exist in nature, or require only a mechanical process of purification or preparation. Such are exemplified by building stones and coal. A large class of minerals, however, have no value in their natural state, but contain valuable elements that can only be released by some metallurgical or chemical treatment. They are illus-

trated by the compounds containing metals, which in their natural state are called ores. The mode of occurrence of the ores, as well as of the non-metalliferous minerals, is the proper field of study of Economic Geology, while the methods employed in their production belong to Mining and Metallurgy.

I. The forms and occurrence of the larger rock masses have already been referred to under Petrology and Structural Geology. The other non-metallic substances will be described in the articles on each specific substance. It is, therefore, only necessary to give as introductory articles those descriptive of the occurrence of the ores. See:

Ore
Ore Deposits
Gangue
Footwall
Hanging Wall
Pinch
Dike
Vein
Lode

II. THE METALLIFEROUS ORES:

1. *Iron Ores*:
Limonite
Hematite
Magnetite

Siderite
Franklinite
Bog-Iron Ore
Blackband Ironstone
Pyrite
Pea Ore

2. *Gold Ores:*

Gold
Calaverite
Hessite

3. *Platinum*

4. *Silver Ores:*

Silver
Argentite
Pyrargyrite
Cerargyrite
Proustite
Stephanite

5. *Copper Ores:*

Chalcopyrite
Cuprite
Malachite

6. *Lead Ores:*

Galena
Anglesite
Cerusite
Pyromorphite

7. *Zinc Ores:*

Blende
Willemite
Zincite
Franklinite
Smithsonite
Calamine

8. *Mercury Ores:*

Cinnabar
Calomel

9. *Manganese Ores:*

Pyrolusite

Manganite
Psilomelane

10. *Aluminum Ores:*

Cryolite
Gibbsite
Bauxite

11. *Tin Ore:*

Cassiterite

12. *Nickel Ores:*

Millerite
Pyrrhotite

13. *Antimony Ore:*

Stibnite

III. THE CARBON MINERALS:

1. Coal

Anthracite
Bituminous Coal
Jet
Lignite
Torbanite
Peat

2. Petroleum

Gas, Natural

3. Asphalt

Bitumen
Albertite
Grahamite
Gilsonite
Maltha

4. Ozocerite

Asphaltic Coal
Mineral Tallow

5. Graphite

IV. BUILDING MATERIALS:

Building Stone
Granite
Sandstone

Limestone
Freestone
Marble
Onyx Marble
Flagstone
Caithness Flagstone
Slate
Bath Stone
Caen Stone
Brownstone
Puzzuolana

V. SOILS, CLAYS, FERTILIZERS, AND
WATERS:

1. Humus
Soil
Loam
Loess
2. Clay
Potters' Clay
Fire Clay
Pipe Clay
Brick Clay
Kaolin
3. Gypsum
Apatite
Phosphorite
Marl
Guano
4. Mineral Waters
Spring
Artesian Wells

VI. SALTS:

Salt
Bay Salt
Borax
Bromine
Iodine

VII. PRECIOUS STONES:

Diamond

Corundum
Quartz
Emerald
Ruby
Beryl
Chrysoberyl
Sapphire
Aquamarine
Tourmaline
Spodumene
Amethyst
Opal
Alabaster
Chalcedony
Carnelian
Sardonyx
Aragonite
Agate
Jasper
Chrysolite
Turquoise
Topaz
Garnet
Rhodonite
Chrysocolla
Catlinite
Benitoite
Smithsonite

VIII. ABRASIVES:

Abrasives
Diamond
Grindstone
Buhrstone
Oil-Stone
Novaculite
Emery
Corundum
Carborundum
Garnet
Diatomaceous Earth
Tripolite
Pumice

IX. PIGMENTS:

Mineral Paints
Graphite
Ochre
Umber
Burnt Sienna
Chalk
Hematite
Slate

Solenhofen Lithographic Stone

Talc
Soapstone
Mica
Feldspar
Fluorite
Sulphur
Asbestic
Asbestos
Magnesite
Fuller's Earth
Monazite

X. MINERALS USED IN VARIOUS ARTS:

Lithographic Stone

G. Biographies of Eminent Geologists

Barrande, J.
Beyrich, H. E. B.
Bishop, K. G.
Brongniart, A.
Buch, L. von
Buckland, W.
Chamberlin, T. C.
Conybeare, W. D.
Cope, E. D.
Cotta, B. von
Dana, J. D.
Darwin, Charles
Daubrée, G. A.
Dawson, Sir J. W.
De la Beche, Sir H. T.
Elie de Beaumont, J. B.
Eichwald, K. E.
Emmons, E.
Forbes, J. D.
Gaudry, A.
Geer, G. de
Geikie, Sir Archibald
Goldfuss, G. A.
Hall, Sir James
Hall, James
Hayden, F. V.
Heer, O.
Heim, A.

Hitchcock, E.
Humboldt, F. H. A. von
Hutton, J.
Koninck, L. G.
Lapparent, A. A. C. de
Lea, I.
Le Conte, J.
Logan, Sir William
Lyell, Sir Charles
Marcou, J.
Marsh, O. C.
Miller, H.
Mojsisovics, E. von
Murchison, Sir R. I.
Newberry, J. S.
Orbigny, A. D. d'
Owen, Sir R.
Phillips, J.
Playfair John
Powell, J. W.
Prestwich, Sir Joseph
Ramsay, Sir A. C.
Roemer, F. A.
Rosenbusch, H.
Saussure, H. B. de
Schimper, W. P.
Sedgwick, A.
Silliman, B.

Smith, W.

Sowerby, J.

Strickland, H. E.

Suess, Eduard

Unger, F.

Werner, A. G.

Winchell, A.

Woodward, S. P.

Zittel, K. A. von

Chapter 23. Meteorology

METEOROLOGY is the study of the atmosphere, its static conditions and appearances, and the changes and movements of all kinds which take place in it. The two principal constituents of the atmosphere are the air and the moisture in various forms which the air holds in suspension. Weather and climate are principally determined by the conditions under which these two constituents exist, at any particular time or habitually. The static conditions of the air which mainly affect the weather are its temperature and its pressure; its movements come under the general term wind. The moisture of the atmosphere, unlike the bulk of the air, is continually changing its identity. It is raised from surface waters by evaporation, held for a time in suspension under various forms, and then returned to the earth's surface by various modes of precipitation.

Besides these two sets of phenomena, the electrical conditions of the atmosphere form an important element of the weather. Other causes sometimes bring about peculiar or unusual weather conditions, and, aside from weather in its strict sense, meteorology takes cognizance of the peculiar optical appearances which the atmosphere presents. These considerations, together with the fact that the practical aspects and practical rather than theoretical investigations hold, perhaps, a more prominent place in meteorology than in other natural sciences, serve to indicate the main divisions of the subject. A considerable number of instruments are used in meteorological investigations, and the articles describing these will be referred to in connection with the appropriate subdivision.

I. GENERAL PRINCIPLES OF THE SCIENCE. See:

Meteorology
Atmosphere
Polarization of Sky Light
Dust
Climate
Weather

2. The instruments used in measuring temperature and radiation are described under:

Thermometer
Actinometer
Actinograph
Radiometer
Pyrheliometer

II. TEMPERATURE AND PRESSURE.

1. The theory and investigation of temperature and its causes are treated under:

Temperature, Terrestrial
Cold Wave
Frost
Snow Line
Actinometry
Thermometry
Seasons

3. For atmospheric pressure and the instruments used in measuring it, see:
Barometer

III. WINDS.

1. There are certain general forms of wind movements recognized without reference to localities. See:

Wind
Storm
Whirlwind

Tornado

Waterspout

Gale

2. On the other hand, in certain parts of the world peculiar local conditions produce winds which have received local names. See:

Doldrums

Calm Latitudes

Blizzard

Chinook

Etesian Winds

Harmattan

Hurricane

Mistral

Sirocco

Monsoon

Simoom

Equinoctial Storm

3. For the instruments and methods used in measuring or observing the winds, see:

Anemometer

Anemograph

Anemoscope

Beaufort Scale

IV. EVAPORATION AND PRECIPITATION.

1. See the general article:

Evaporation

2. The various forms in which moisture is held suspended are described under:

Humidity

Haze

Fog

Cloud

3. For the various forms of precipitation, see:

Dew

Hoar Frost (under Frost)

Rain

Cloudburst

Snow

Hail

4. For the instruments used in measuring or observing the moisture of the atmosphere, see:

Hygrometer

Drosometer

Nephoscope

Rain Gauge

V. ELECTRICAL CONDITIONS AFFECTING THE WEATHER. See:

Atmospheric Electricity

Lightning

Lightning, Accidents from

Lightning, Protection from

VI. PECULIAR OR UNUSUAL WEATHER CONDITIONS ARE DESCRIBED IN THE ARTICLES:

Dust

Dark Day

Black Rain

Blood-Rain

Indian Summer

VII. OTHER PHENOMENA OF THE ATMOSPHERE BELONG MAINLY TO OPTICAL APPEARANCES OR ELECTRICAL DISPLAYS. See:

Rainbow

Fog-Bow

Halo

Scintillation

Mirage

Fata Morgana

Aurora Borealis

Elmo's Fire, Saint

Castor and Pollux

VIII. PRACTICAL INVESTIGATIONS IN METEOROLOGY ARE GENERALLY CONDUCTED BY GOVERNMENT BUREAUS. See:

Weather Bureau

Signal Corps, U. S. Army

These bureaus warn the public by a system of signals. See:

Storm and Weather Signals

And in this connection also:

Fog Signals

They also issue daily weather maps.
See:

Isothermal Lines

Isobarometric Lines

Isograms

Isabnormal Lines

Isanomalous Lines

**IX. FOR BIOGRAPHIES OF THE MOST
PROMINENT METEOROLOGISTS, see:**

Abbe, Cleveland

Espy, James Pollard

Fonvielle, Wilfrid de

Maury, M. F.

Pernter, J. M.

Wild, H.

Chapter 24. Geography

GEOGRAPHY is the description of the surface of the earth in all its aspects. Just as the place where the atmosphere is where the lithosphere meets the hydrosphere, so do the sciences of METEOROLOGY and GEOLOGY meet in that of GEOGRAPHY, and the last to a certain extent encroaches upon the fields of the other two. The subject is very wide, covering a regional study of the upper layers of the earth's crust, a regional study of the atmosphere, or the climatic conditions prevailing on the various parts of the surface. Thus, in the consideration of any region on the earth, we should study the character of the land configurations, the bodies of water (rivers, lakes, seas, etc.) and their influences, the flora and fauna and their relationship to the other physical features, and, finally, the human inhabitants, their character and activities. Of course, we should also consider region as a whole and its relationship to other parts of the earth.

The whole subject may be broadly divided into three main branches: Mathematical Geography, which deals with the form, dimensions, and position of the earth, and the methods of its delineation; Physical Geography, which is a general discussion of the various natural features of the earth's surface, and Political, Regional, or Descriptive Geography, which gives detailed and specific descriptions of the separate parts of the earth's surface, generally as its human inhabitants have divided it among themselves, all their varied activities, and all the artificial changes which they have made, and the structures which they have built.

A. Mathematical Geography

I. GENERAL. See:

Earth
Pole
Equator, Terrestrial
Meridian
Latitude and Longitude
Degree of Latitude
Degree of Longitude
Tropics
Geography
Zone

Globe
Coast and Geodetic Survey
Geodesy
Surveying

III. TERRESTRIAL MAGNETISM. See:

Magnetism, Terrestrial
Declination
Dip
Isoclinic
Isogonic Lines
Isodynamic Lines
Compass
Theodolite
Sextant

II. METHODS OF DELINEATION. See:

Map
Chart

B. Physical Geography

Under this head will be given the articles dealing with geographical features that are due to various geological or climatic causes. The articles on the causes themselves are referred to under Geology and Meteorology. At the end of each subdivision are given the articles on the most remarkable examples of the features discussed. In connection with this section the departments of Zoölogy and Botany should also be consulted.

I. GENERAL ARTICLE. See:

Physiography

II. OCEANOGRAPHY:

Oceanography
Ocean
Deep-Sea Exploration
Sounding
Abysmal Accumulations
Oceanic Deposits
Ocean Currents
Tides
Bore
Channel
Shore
Gulf Stream
Atlantic Ocean
Pacific Ocean
Indian Ocean

III. GENERAL LAND FORMS:

Aiguille
Archipelago
Butte
Cordillera
Continent
Island
Isthmus
Mountain
Valley

Plateau
Sierra
Basin
North America
Australia
Himalaya
Malay Archipelago
Panama, Isthmus of
Sierra Nevada

IV. HYDROGRAPHY:

Hydrography
Bayou
Bog
River
Divide
Waterfall
Inundation
Flood Plain
Delta
Reef
Bar
Lake
Floating Island
Mississippi River
Amazon River
Nile
Great Lakes

V. GEOGRAPHICAL FEATURES DUE TO MOVEMENTS OF THE EARTH'S CRUST:

Beaches, Raised
Earthquake
Estuary
Fiord
Coastal Plain
Great Rift Valley

VI. FEATURES DUE TO VOLCANIC AC- TION:

Volcano
Crater

Geyser
Dike
Laccolote
Vesuvius
Etna (Ætna)
Krakatoa
Pelée, Mont
Hecla
Mauna Loa
Kilauea
Soufrière, La
Popocatepetl
Yellowstone National Park
Palisades
Giant's Causeway
Staffa

VII. FEATURES DUE TO EROSION:

Erosion
Piedmont Plain
Bad Lands
Cliff
Talus
River Terraces (under Terrace)
Cañon
Mesa
Sink Hole
Cave
Karst
Delaware Water Gap
Colorado River
Niagara River and Falls
Victoria Falls
Mammoth Cave
Luray Cave
Natural Bridge
Yosemite Valley

VIII. FEATURES DUE TO GLACIAL ACTION:

Glacier
Moraine
Iceberg (under Ice)
Avalanche
Drumlin
Eskers
Giants' Kettles
Rocking Stones
Mer de Glace
Gorner Glacier

IX. FEATURES DUE TO WIND ACTION:

Dune
Medano
Musical Sand

X. FEATURES DUE TO PECULIAR SOIL OR CLIMATIC CONDITIONS:

Desert
Oasis
Prairie
Savannas
Steppe
Tundra
Downs
Llanos
Pampas
Karroo
Sahara
Gobi

XI. FEATURES DUE TO THE ACTION OF ANIMALS:

Coral Island
Atoll
Barrier Reef

C. Political or Regional Geography

This is by far the most important part of geographical study, and, taken as a whole, is probably the largest and most valuable department of the New INTERNATIONAL ENCYCLOPÆDIA. Lack

of space makes it impracticable to enumerate all of the important articles in the work connected with a study of Political Geography. The next best thing would be an outline of geograph-

ical history and knowledge, which would of itself suggest further fields of investigation.

The earliest geographic knowledge dates back to about 600 B. C. Hecataeus was one of the first cartographers, and at about 500 B. C. made a map of the world as known then, showing the existence of two continents. Herodotus distinguished three continents, Aristotle demonstrated that the world was round, and Eratosthenes computed the length of the earth's circumference to be 25,000 miles. Ptolemy extended the knowledge of the world by a vast amount and drew maps that were used by Columbus over thirteen centuries later.

In the line of exploration, the Phœnicians were the first nation of discoverers. With the Carthaginians and the Egyptians their trading brought them into many unknown regions, which they frequently colonized. The Arabs contributed a large amount of geographic knowledge during the Middle Ages and the Norsemen colonized Iceland and Greenland and explored the northern seas.

The names connected with geographical knowledge up to the fifteenth century, when the period of modern explorations began, are in the following list:

I. ANCIENT:

Hecataeus of Miletus
Herodotus
Eratosthenes
Pythagoras
Ptolemy
Aristotle
Strabo
Tyre
Pytheas of Marseilles

Alexander the Great
Masudi
Edrisi
Ibn Batuta
Ericson, Lief
Benjamin of Tudela

II. MEDIEVAL:

Rubruquis
Polo, Marco
Clavijo
Conti, Niccolò dei

Modern exploration dates from the fifteenth century, particularly from the time of Prince Henry of Portugal. The discovery of the Cape of Good Hope and the utilization of the magnetic compass lent impetus to the navigation of the high seas and consequent discoveries. These were at first confined to Africa, in a search for an all-water route to India. Then came Columbus, who discovered the West Indies (America). This marked the beginning of a series of discoveries that resulted in the uncovering of the entire Western Hemisphere and the establishment of the main features of the globe on both land and sea. With this accomplished, the attention of the world turned to the opening up and development of the newly discovered lands. North and South America, Africa, Asia, Australia, and many of the Pacific Islands were all fields of endeavor in the search for growth of trade and wealth. Many places were discovered and explored by men of different countries and disputes frequently arose over their possession. All of the maritime nations, particularly Portugal and Spain, took part, the names of hundreds of men finding their way into the annals of history.

In the following list are men prominent in early exploration and discovery. The names will suggest articles on the regions explored and other places affected.

Men and places involved in early discovery and exploration:

I. SOUTH AMERICA:

Pizarro, Francisco
Drake, Sir Francis
Hawkins, Sir Richard
Magalhães, Fernão de

II. NORTH AMERICA:

Columbus, Christopher
Vespucius, Americus
Cabot, John
Cabot, Sebastian
Balboa, Vasco Nuñez de
Cortés, Hernán
Soto, Hernando de
Cartier, Jacques

III. AFRICA:

Cadamosto
Días de Novães, Bartholomeu
Gama, Vasco da
Henry the Navigator

IV. SOUTH SEA AND PACIFIC OCEAN:

Tasman, Abel Janszoon
Cook, Capt. James
Entrecasteaux, Joseph Antoine
Bruni, Chevalier d'

Exploration in Africa, at first entirely confined to the Portuguese, became the attention of other nations toward the end of the 18th century, when James Bruce, an Englishman, seeking the source of the Nile, discovered the Blue Nile. He heads a very long list of African explorers, more prominent among whom are Mungo Park, Heinrich Barth, David Living-

stone, H. M. Stanley, Gerhard Rohlfs. There are still parts of this continent, South America and Asia, which are quite unknown. These are slowly being uncovered by men who are accomplishing difficult and arduous tasks with little or no glory.

The main attention of the world in modern times has been directed toward the explorations of the Polar Regions. At first actuated by purely commercial incentives, the efforts of explorers to-day are directed in the interest of science. The earliest explorations in the North Polar regions, however, were caused by the search for the Northwest Passage to the Orient. The men prominently connected with this in particular were the Cabots, Henry Hudson, Parry, Cook, Rae, Simpson, Franklin and McClure. The Antarctic has received less attention than the northern fields on account of its remoteness, and it is only recently that any valuable work has been done there. In this connection Shackleton, Scott and Amundsen stand out prominently among the few South Polar explorers.

Recent successes in the Polar Regions are directly attributable to the lessons learned in early work there and to the advance in scientific knowledge, which gave to the men advantages never had by early explorers. Both Poles have finally been attained, the North Pole by Peary (April 6, 1909), and the South Pole by Amundsen (December 4, 1911) and Scott (January 18, 1912). See articles POLAR RESEARCH, NORTHWEST PASSAGE.

POLAR EXPLORERS. See:

Amundsen, R.
Back, G.

Baffin, W.
Barents, W.
Bering, V.
Cook, J.
Franklin, J.
Greely, A. W.
Hudson, H.
Kotzebue, O. von
McClure, R. J. le M.
Mawson, D.
Nansen, E.
Nordenskiöld, N. A.
Parry, W. E.
Payer, S.
Peary, R. E.
Ross, J. C.
Ross, J.
Scott, R. F.
Shackleton, E. H.
Stefansson, V.
Sverdrup, O.
Vancouver, G.
Vilkitsky, B. A.
Wellman, W.
Weyprecht, K.
Wilkes, C.

Lack of space forbids anything like an enumeration of even the more important articles describing the various parts of the earth and their inhabitants. The bulk of minor gazetteer articles are intended only for incidental reference, when information about a particular locality is desired. Nevertheless, it would be possible to plan a very instructive and interesting course of systematic reading in descriptive geography.

One way would obviously be to read first the articles on the larger divisions of the earth, EUROPE, ASIA, AFRICA, AMERICA, AUSTRALIA, ARCTIC REGION, and ANTARCTIC REGION, and, in the latter connection, the article on

POLAR RESEARCH. These articles give, besides, a general geographic and ethnographic description, and a history of exploration and discoveries from ancient to recent times. They also refer to the separate divisions of the larger land areas, and, by reference to the articles on these divisions, the reader will be carried successively into narrower and narrower fields with more and more detailed description.

The story of explorations and discoveries, and of the science of geography, may also be carried further by means of the following names and titles:

Andrée, S. A.
Baker, S. W.
Barth, H.
Behaim, M.
Borchgrevink, C. E.
Brazza, P.
Burckhardt, J. L.
Burton, R. F.
Chancellor, R.
Flinders, M.
Gray, R.
Hakluyt, R.
Hedin, Sven
Johnston, H. H.
Kane, E. K.
Kiepert, H.
Kingsley, M. H.
Kohl, J. G.
La Hontan, A. L.
Lander, R. L.
Lapérouse, J. F.
Lockwood, J. B.
Major, R. H.
Malte-Brun, K.
Markham, C. R.
Przhevalski, N. M.
Ratzel, F.
Ravenstein, E. G.

Reclus, E.
Rennel, J.
Ritter, K.
Speke, J. H.
Sturt, C.

Still an other method of carrying on the study of geography would be to study the maps, and, wherever a particular region found there excites the reader's curiosity, turn to the appropriate article. Many other ways will suggest themselves, according to the individual's tastes, inclination, or requirements, and it will be found that an encyclopædia is the best means of gaining, not only a minute knowledge of any particular locality on the earth's

surface, but also a broad perspective view of the whole field of human activity. For the gazetteer articles are not to be regarded merely as dealing with topics in geography. Taking any of the articles on the various countries of the globe, as the UNITED STATES, or JAPAN, such article may be made to supply detailed information on whatever topic may be the subject of study or reading: Zoölogy, Geology, Statistics, Finance, Education, Industry, or Transportation. To quote these articles and the accompanying maps would be to encumber the book with enormous lists of names, which the reader may be trusted readily to select for himself.

Chapter 25. Botany

BOTANY is the science that deals with plants in all their aspects,—their origin and development, nature, structure, life processes, classification, and distribution. The nature and origin of plants will be discussed in the general articles given below. All considerations of the form and structure of individual plants may be broadly classed under the general term Structural Botany, or Plant Anatomy. The study of the processes which constitute the life of a plant and the conditions which affect those processes is called Physiology. These two branches of the science are sometimes united under the term General Botany, as distinct from Specific or Systematic Botany, also called Taxonomy, which deals with the classification and description of the various kinds of plants. A somewhat recently established branch of the science is that of Ecology, which deals with the distribution of plants in general. Another branch represents the practical aspects of botany by a particular investigation of the plants which can be made to enter into human economy. This is Economic Botany, the science which has the closest bearing on the arts of agriculture and horticulture. For a general discussion of botanical science, see:

Botany
Biology
Evolution
Heredity

For General Methods of Botanical Investigation, see:

Botanical Laboratories (under Laboratory)
Botanic Garden
Herbarium
Index Kewensis

A. Structural Botany

This subject deals with the form and structure of individual plants, of the plant body as a whole, of its separate limbs and organs, of the various tissues of which these are composed, and of the minute structures of the cells which compose the tissues. The study of the individual cell has recently received so much attention that it has been elevated from a branch of Histology, which deals with the microscopic nature of tissues, to the separate science of Cytology. The study of the varying types of organs has been called Morphology, and this branch may be

divided into the morphology of the sterile or vegetative organs and the morphology of the reproductive organs.

For General Articles on Structural Botany, see:

Vegetable Tissue
Anatomy of Plants
Growth (in Plants)
Morphology

I. CYTOLOGY. A description of the general structure and contents of the cell is given in the articles:

Cytology

Cell (in Plants)
 Intercellular System
 Protoplasm
 Nucleus
 Osmosis
 Plasmolysis
 Movement
 Rotation

For the composition of the cell wall, see:

Cellulose
 Lignin
 Lignification
 Micellar Theory

For the structure of the nucleus, see:

Nucleolus
 Linin
 Chromatin
 Chromosome
 Centrosome

For the cytoplasm, see:

Microsome
 Plastids

The protoplasmic contents include a considerable variety of coloring matter. See:

Color in Plants
 Chromoplast
 Chromatophore
 Endochrome
 Chloroplast
 Anthocyan
 Chlorophyll
 Leucoplasts
 Elaioplasts
 Erythrophyll
 Etiolin
 Etiolation
 Carotin
 Cyanophyll
 Phycoerythrin

Phycophaein
 Pyrenoid

Besides the protoplasm the cell often contains crystals and other bodies.
 See:

Raphides
 Aleurone
 Inulin
 Starch

Finally the various constituents of the sap, digestive ferments, and secretions:

Sap
 Sugar
 Glucose
 Enzyme
 Diastase
 Cytase
 Lipase
 Invertase
 Oxidase
 Pectase
 Zymase
 Latex

The mechanics of cell division are described under:

Mechanics of Development
 Fission
 Mitosis
 Karyokinesis
 Blepharoplast

II. HISTOLOGY. A general discussion of plant tissues is given in the article HISTOLOGY, section on *Histology of Plants*.

Tissues are variously classified. According to their general nature, the two most important kinds are described under:

Parenchyma
 Collenchyma

In higher plants, the tissues are gen-

erally differentiated into three main systems. See:

Pith
Wood
Cortex

The general articles on woody tissue are:

Alburnum
Duramen
Vascular Tissue
Conducting Tissue
Mechanical Tissue
Mestome
Plerome

For the special structure of wood, see:

Fibrovascular Bundle
Fibre
Phloem
Bast
Hadrome
Leptome
Tylosis
Tracheæ (under Anatomy of Plants)
Tracheid
Sieve Vessels
Cambium
Pericycle
Medullary Ray

The various tissues found in the cortex are described in the articles:

Meristem
Epidermis
Cuticle
Endodermis
Hypodermis
Periblem
Dermatogen
Bark
Cork
Phelloderm
Phellogen

Other special forms of tissue are:

Aërenchyma
Palisade Cells
Mesophyll

III. MORPHOLOGY OF THE VEGETATIVE ORGANS.

For the general forms of plant bodies, see:

Thallus
Herb
Shrubs
Tree
Juvenile Forms

Some of the special forms or organs of fungi are described under:

Hypa
Mycelium
Plasmodium
Pileus

Higher plants are generally differentiated into stem, root, and leaves, all of which may carry minor organs or appendages. See:

Stem
Root
Leaf

For special forms of stems, see:

Tuber
Corm
Internode
Fasciation
Phylloclad

For their mode of branching:

Branching
Monopodial Branching
Dichotomy

For the forms and appearance of leaves, see:

Fronde
Pinnule
Phyllodes

Petiole
Venation
Variegation
Anisophylly
Heterophylly

For their arrangement in the bud,
see:

Leaf-Buds (under Bud)

The forms and appendages of the
roots are described in the articles:

Root
Rhizoids
Root Tubercles

For the organs of respiration and
exudation, see:

The Aërating System (under Anat-
omy of Plants)
Stomata
Lenticels
Hydathode

For the organs of support and sim-
ilar use, see:

Tendril
Haustoria

Other appendages of plants are de-
scribed under:

Trichome
Gland
Cilia of Plants
Bloom

IV. MORPHOLOGY OF THE REPRO- DUCTIVE ORGANS.

The vast majority of plants produce
at certain periods of their life-history
two sets of reproductive organs, the
sexual and the asexual; and, in all
plants above the algæ and fungi, these
follow each other regularly in alter-
nate generations. (See the general
articles on sexual processes referred to
under Physiology.) In this section,
only those articles will be given which

describe the sexual and asexual repro-
ductive organs. These organs are
present in some form throughout large
classes of plants. Special morphology
will be discussed under the appropriate
heads in Systematic Botany.

Asexual reproduction is effected by
spores and by vegetative off-shoots.
For the latter, see:

Bud
Gemmæ
Bulb

For the organs of spore-reproduc-
tion, see:

Spore
Intine
Homospory
Heterospory
Microspore
Megaspore
Sporangium
Microsporangium
Megasporangium
Sporophyll
Microsporophyll
Megasporophyll

The organs of sexual reproduction
are:

Gamete
Generative Cell
Oösphere
Sperm
Antheridium
Archegonium
Oögonium
Paraphyses
Oöspore

In the higher plants (Spermato-
phytes), the two sets of reproductive
organs, sexual and asexual, are enclosed
together in the flower. See:

Flower
Seed
Fruit

For the various modes in which flowers are arranged on the plant, see:

Inflorescence
Panicle
Cyme
Corymb
Ament
Disk

The parts of a flower are described in the articles:

Involucre
Calyx
Pappus
Corolla
Petal
Ligule
Nectary
Pistil
Ovary
Carpel
Ovule
Placenta
Stamen
Anther
Pollen

Epigyny
Hypogyny
Perigyny

The articles on the seed are:

Seed
Endosperm
Perisperm
Ovule
Nucellus
Embryo
Suspensor
Cotyledon
Hypocotyl

For the various kinds of fruits, see:

Achene
Berry
Capsule
Caryopsis
Drupe
Drupelet
Follicle
Glume
Legume
Nut
Pome

B. Physiology

Physiology is the science which deals with all the processes that constitute the life of an individual plant, the conditions, both internal and external, which affect plant life, and all the phenomena attending such processes and conditions. Just as we distinguish between vegetative and reproductive organs of a plant, so we may also distinguish between vegetative and reproductive life processes; and the former may be divided into the regular and constant processes, which maintain the

life of a plant, and the more occasional responses to stimuli. Abnormal and pathological conditions also come within the scope of physiology. See **PHYSIOLOGY OF PLANTS.**

I. In all perfect plants, there is a series of regular mechanical processes by which raw food material is brought to the digestive organs in the form of gases from the atmosphere, or of minerals dissolved in water from the soil; by other processes the digested food is carried to places of storage or growing

points, and the waste products are expelled from the system. See:

Respiration (in plants)

Aëration

Absorption (in plants)

Transpiration

Potometer

Imbibition

Osmosis

Turgor

Root Pressure

Conduction

Storage

Excretion

Secretion (vegetable)

II. The phenomena of digestion and growth are described in the articles:

Digestion in Plants

Food of Plants

Nutrition (in plants)

Mycorrhiza

Photosynthesis

Etiolation

Metabolism

Katabolism

Anabolism

Fermentation

Assimilation

Regeneration

Parasite, Plant

Saprophyte

Carnivorous Plants

Insectivorous Plants

Energy of Plants

Growth (in plants)

Auxanometer

Enzymes

Chloroplasts

Carotin

Etiolin

The various movements which plants are capable of are described under:

Movement

Moving Plant

Motor Organ

Locomotion

Nutation (in plants)

Plants are also capable of reacting to a great variety of stimuli. See:

Irritability

Stimulus

Tropism

Phototaxis

Heliotropism

Photoepinasty

Apheliotropism

Paraheliotropism

Nyctotropic

Sleep of Plants

Geotropism in Plants

Apogeotropism

Diageotropism

Hydrotropism

Aphydrotropism

Aërotropism

Rheotropism

Thermotropism

Chemotaxis

Chemotropism

Electrotaxis

Electrotropism

Traumatropism

Sensitive Plant

Hyponasty

Epinasty

Clinostat

Tendrils

Lianas

Reproductive processes may be divided into those which take place within the individual plant, and those which are affected by the relation of the individual plant to its environment. The latter are referred to under Ecology (see C below), while only the former are described in the following articles:

Reproduction (in plants)

Vegetative Propagation

Sex in Plants (under Sex)

Conjugation

Rejuvenescence

Isogamy

Apogamy

Parthenogenesis

Vivipary

Fertilization

Germination

Alternation of Generations

Gametophyte

Sporophyte

A discussion of the abnormal and pathological in plant life is given in the articles:

Teratology

Monstrosity

Malformation

Abortion in Plants (under Abortion)

Vestigial Structures

Concrescence

Galls

C. Ecology

Ecology is the science that deals with the relation of a plant to its environment. This relation may be that of sexual intercourse, relation to the soil, situation, climate, moisture conditions, relation to other plants and to animals, and any other external conditions that affect the situation of a plant, its growth, or the length of its life, either in the individual or in the species or race. Ecology is thus the study of the distribution of plants in the broadest sense. See:

Ecology

Distribution of Plants

Bionomics

Floristics

Dysteleology

Adaptation

Epharmony

1. The relations of the reproductive functions of a plant to the environment are discussed in the articles:

Pollination

Pollen

Hybrid

Dispersal

The special arrangements which

affect cross-pollination are described under:

Cleistogamy

Allogamy

Geitonogamy

Monœcism

Diœcism

Dichogamy

Entomophilous Plant

Anemophilous Plants

Hydrophilous

For the relation of plants to the soil, see:

Humus Plants

Lime Plants

Clay-Plants

Nitrophilous Plants

Halophyte

Dune Vegetation

Rock Plants

Epiphyte

For the relation of plants to general localities, see:

Autochthonous

Endemism

Naturalization

Migration of Plants

and, to specific situations:

Mountain Plants

Alpine Plant

Cliff-Plants

Beach Plants

Ruderal Plants

Hylophytes

Benthos

Enalids

Plankton

For the relation of a plant to moisture and climate, see:

Hydrophytes

Hygrophytes

Mesophyte

Amphibious Plants

Xerophytes

Desert Vegetation

Arctic Plants (under Arctic Region)

Acclimatization

Phenology

The relation of a plant to other plants, and to animals, may be considered under two aspects:

(a) There is often a close sympathetic relation between individual plants, and between an individual plant and animals. See:

Symbiosis

Endophyte

Epiphyte

Parasite, Plant

Obligate Plants

Facultative Plant

Entomophilous Plant

Myrmecophytes

Phycomycetes

(b) There is also a general relation due to soil, climate, struggle for existence, etc., between large numbers of individuals growing together and constituting what are known as plant societies. See:

Distribution of Plants

Form

Formation

Forest

Jungle

Thicket

Grasslands

Savannas

Steppe

Prairie

Llanos

Pampas

Meadow

Tundra

Swamp

Mangrove Swamp

Cypress Swamps

The nature of plant societies is also largely affected by the vegetative duration of its members. See:

Duration

Annuals

Biennials

Perennials

Æstival

Vernal Grass

Deciduous Plants

Evergreen

Geophyte

D. Systematic Botany

This branch of the science of Botany comprises the classification of plants, the description of every known species

and of the larger divisions—genera, families, orders, classes, etc.—into which all species are grouped. Sys-

tematic Botany also includes the study of the relationships between the various groups and species of plants, and of their geographical distribution. It is obviously impossible here to refer to all the articles on even the more important genera; but, as the representative genera of each order are referred to in the article on the order, it is sufficient to give only the latter and the higher groups. For a general article on systematic botany, see TAXONOMY.

The whole vegetable kingdom is generally divided into four sub-kingdoms. See:

Thallophytes
Bryophytes
Pteridophytes
Spermatophytes

I. The Thallophytes are divided into two parallel series. See:

Algæ
Fungi

1. The Algæ are generally grouped into four classes. See:

Cyanophyceæ
Chlorophyceæ
Phæophyceæ
Rhodophyceæ

2. For the main divisions of the Fungi, see:

Myxomycetes
Schizomycetes
Ustilaginales
Phycomycetes
Ascomycetes
Uredinales
Basidiomycetes
Lichens

II. The Bryophytes are grouped in two main divisions. See:

Hepaticæ

Musci

III. The living Pteridophytes fall into three main groups, the last two of which are generally called "the higher fern." See:

Fern
Equisetum
Lycopodiales

IV. The Spermatophytes, or seed-plants, form the bulk of the vegetation which covers the earth. They are divided into two classes. See:

Gymnosperms
Angiosperms

1. The living Gymnosperms are grouped into four orders. See:

Coniferæ
Cycadaceæ
Gnetaceæ
Ginkgo

2. The Angiosperms consist of numerous orders, which fall into two natural sub-classes. See:

Monocotyledons
Dicotyledons

(a) The principal orders of Monocotyledons are described under:

Pandanaceæ
Typha
Gramineæ
Cyperaceæ
Palm
Arum
Bromeliaceæ
Liliaceæ
Smilaceæ
Amaryllidaceæ
Dioscoreaceæ
Iridaceæ
Musaceæ
Zingiberaceæ
Orchid

(b) The following are the most important orders of Dicotyledons, arranged in their order of relationship. Important genera of orders not separately described are inserted in their proper places.

Archichlamydeæ:

Mainly Apetalous. Chiefly

Trees:

Piperaceæ

Juglandaceæ

Willow

Poplar

Birch

Alder

Cupuliferæ

Moraceæ

Urticaceæ

Elm

Chiefly Weeds:

Polygonaceæ

Chenopodiaceæ

Amarantaceæ

Mesembryaceæ

Caryophyllaceæ

Mainly Polypetalous. Buttercup Types:

Nymphæaceæ

Magnolia

Ranunculaceæ

Berberidaceæ

Lauraceæ

Poppy Types:

Papaveraceæ

Fumariaceæ

Cruciferæ

Insectivorous Plants:

Sarracenia

Sundew

Rose Types:

Saxifrage

Plane

Rosaceæ

Leguminosæ

Geranium Types:

Geranium

Zygophyllaceæ

Polygala

Euphorbiaceæ

Maple Types:

Burseraceæ

Anacardiaceæ

Holly

Maple

Sapindaceæ

Horse-Chestnut

Buckthorn Types:

Rhamnaceæ

Vitaceæ

Mallow Types:

Tiliaceæ

Malvaceæ

Violet Types:

Ternstroemiaceæ

Violaceæ

Cactus Type:

Cactus

Myrtle Types:

Lythraceæ

Myrtaceæ

Carrot Types:

Umbelliferæ

Dogwood

Sympetalaæ:

Heath Types:

Ericaceæ

Huckleberry

Primrose Type:

Primulaceæ

Ebony Types:

Sapotaceæ

Ebony

Gentian Types:

Loganiaceæ
Gentianaceæ
Apocynaceæ
Asclepiadaceæ

Phlox Types:

Convolvulaceæ
Polemoniaceæ
Boraginaceæ
Labiatæ

Solanaceæ

Scrophulariaceæ
Bignonia

Madder Types:

Rubiaceæ
Caprifoliaceæ

Bell-Flower Types:

Cucurbitaceæ
Campanulaceæ
Compositæ

E. Economic Botany

In its narrow sense, viewed as a strictly botanical science, economic botany is the study of those plants which are, or can be, used for some purpose in human economy. If we inquire further into the methods by which these plants are made available, we enter upon the fields of agriculture, pharmacy, mechanical arts, etc. By the above definition, economic botany includes a study of the common cultivated plants, such as the cereals, but, to avoid repetition, the cultivated plants are referred to only in the chapter on Agriculture, Horticulture, and Forestry. We shall therefore confine ourselves here to the articles describing the important wild, or not commonly cultivated, economic plants, classified according to their uses.

I. PLANTS USED FOR FOOD:

Adansonia
Areca
Banana
Brazilnuts
Breadfruit Tree
Butter-Tree
Caryocar
Caryota

Cashew Nut
Cherimoyer
Cocco
Cocoanut
Euryale
Fungi, Edible
Granadilla
Grass-Tree
Hog-Plum
Iceland Mose
Jubæa
Mammee Apple
Maple
Mushroom
Nelumbo
Palmyra Palm
Papaw
Prickly Pear
Reindeer Moss
Sago
Tamarind
Ti
Walnut
Water-Chestnut

II. PLANTS USED IN PREPARING BEV-

ERAGES:

Beverage Plants
Agave
Assai

Ava
Buriti Palm
Carrageen
Elder
Maté
Palmyra Palm
Sloe
Woodruff

**III. PLANTS USED AS CONDIMENT OR
IN CONFECTIONERY:**

Flavoring Plants
Anise
Caper
Cardamom
Cinnamon
Coriander
Ginger
Jujube
Juniper
Laurel
Licorice
Marjoram
Marsh-Mallow
Mint
Pepper
Tonka Bean
Vanilla

IV. PLANTS USED IN PERFUMERY:

Boswellia
Lemon-Grass
Lignum Rhodium
Lily of the Valley
Musk Plant
Myrrh
Patchouli
Ylang Ylang

V. PLANTS YIELDING PIGMENTS:

Alkanet
Aloe
Brazil Wood
Buckthorn
Butea

Camwood
Chay Root
Fustic
Henna
Indigo
Logwood
Marking-Nut
Walnut
Weld
Yam
Zamia

**VI. PLANTS YIELDING GUMS, WAX,
OILS, ETC.:**

Butter Tree
Calophyllum
Canarium
Candleberry
Candle-Nut
Carnauba Palm
Cashew Nut
Dammar
Elæococca
Fir
Grass-Tree
Mastic
Mesquite Tree
Oil Palm
Pine
Tallow Tree

VII. PLANTS YIELDING FIBRE:

Agave
Aloe
Astrocaryum
Attalea
Bromelia
Broom
Butea
Carnauba Palm
Caryota
Chamærops
Corchorus
Crotalaria

Eriodendron
Giant Lily
Gomuti
Jute
Kapok
Ootrum
Piassaba
Yucca

VIII. PLANTS USED FOR TIMBER AND
CABINET WOOD:

Ash
Boxwood
Butternut
Calophyllum
Cedar
Cypress
Dacrydium
Dalbergia
Elm
Eucalyptus
Fir
Gmelina
Greenheart
Guaiacum
Hemlock Tree
Hornbeam
Ilex
Kauri Pine
Lignum Vitæ
Lime Tree
Mammee Apple
Maple
Oak
Palmetto
Palmyra Palm
Pine
Plane
Podocarpus
Spruce
Tamarind
Teak
Tulip Tree
Walnut

IX. PLANTS USED FOR ORNAMENTAL
CABINET WOODS:

Aloes Wood
Ebony
Holly
Letterwood
Mahogany
Palmyra Wood
Rosewood
Sandalwood
Satinwood

X. PLANTS SUPPLYING VARIOUS PRIM-
ITIVE NEEDS:

Bottle Gourd
Bussu Palm
Calabash Tree
Daphne
Nipa
Palmyra Palm
Papyrus
Rattan

XI. PLANTS USED DIRECTLY IN IN-
DUSTRIAL ARTS:

Carludovica Palmata
Ice Plant
Ivory, Vegetable
Myrobalan
Oak
Quebracho
Rattan

XII. MEDICINAL PLANTS:

Aconite
Acorns
Adansonia
Agrimony
Akee
Allamanda
Aloe
Alum Root
Angelica
Angostura Bark
Aristolochia
Arnica

Asarabacca
 Belladonna
 Bittersweet
 Broom
 Butterfly-Weed
 Cajeput
 Calabar Bean
 Carrageen
 Cascarilla
 Cassia
 Centaury
 Choke-Cherry
 Cinchona
 Cissampelos
 Coca
 Croton
 Cubebs
 Dill
 Dock
 Dogbane
 Elder
 Erigeron
 Ergot
 Eucalyptus
 Feverwort
 Gentian
 Geum
 Guaiacum
 Horehound
 Houseleek
 Ipecacuanha
 Jalap
 Licorice
 Mint
 Myrrh
 Poppy
 Strychnos
 Witch-Hazel
 Zanthoxylum

XIII. POISONOUS PLANTS:

Poisonous Plants
 Abrus
 Amanita

Andromeda
 Belladonna
 Bittersweet
 Bitterwood
 Calabar Bean
 Cherry-Laurel
 Coccus Indicus
 Colchicum
 Fungi, Edible and Poisonous
 Hemlock
 Henbane
 Kalmia
 Laburnum
 Manchineel
 Nightshade
 Poison Oak
 Stramonium
 Sumach
 Tanghin
 Upas

XIV. BIOGRAPHIES OF EMINENT BOTANISTS:

Adanson, M.
 Barton, W. P. C.
 Bauhin, J.
 Bentham, G.
 Bigelow, J.
 Bonnier, G.
 Boussingault, J. B. J. D.
 Braun, A.
 Brongniart, A. T.
 Brown, R.
 Brunfels, O.
 Chapman, A. W.
 Cohn, F. J.
 Darlington, W.
 De Candolle, A. L. P. P.
 Desfontaines, R. L.
 Eichler, A. W.
 Engler, H. G. A.
 Endlicher, S. L.
 Gray, Asa
 Grew, N.

Hellriegel, H.
Hooker, Sir J. D.
Hooker, Sir W. J.
Jackson, B. D.
Jussieu
Ledebour, K. F. de
Lenné, P. J.
Lindley, J.
Link, H. F.
Linnæus, Carolus
Michaux, A.
Mohl, H. von
Morong, Thomas
Muhlenberg, G. H. E.
Nees von Esenbeck, C. G.
Nuttall, T.

Persoon, C. H.
Pfeffer, W.
Plumier, Charles
Rafinesque, C. S.
Sachs, J. von
Saussure, N. T. de
Schleiden, M. J.
Schultze, M. S.
Schweinitz, L. D. von
Sullivant, W. S.
Thunberg, K. P.
Thurber, George
Torrey, J.
Tournefort, J. P. de
Unger, F.
Watson, S.

Chapter 26. Agriculture, etc.

THE systematic and artificial cultivation of plants for the purpose of supplying human necessities or luxuries constitutes the arts of Agriculture, Horticulture, and Forestry, or the cultivation of the field, the garden, and the forest. The distinctions between these three arts, however, are not so definite as one might suppose, and the apportionment among them of the articles dealing with plant culture will be more or less arbitrary. Thus Forestry and Horticulture meet in the arts of Arboriculture and Landscape Gardening. The products of Horticulture are, as a rule, luxuries rather than necessities; but the raising of vegetables for the table, although they are almost necessary articles of food, is generally treated under Horticulture rather than under Agriculture. The latter term is best confined to the cultivation on a large scale of products used extensively in human economy, and this distinction will be the basis for the following divisions of the whole subject.

A. Agriculture

Agriculture, as its name implies, is the cultivation of the field, mainly for the purpose of providing a regular supply of organic food, both plant and animal. This indicates the two main divisions of farming, namely, the raising of food plants and the raising of animals. The former is, perhaps, the more complex process, requiring a more elaborate equipment of tools and machinery. It involves the selection and preparation of the soil, the sowing of the seed, the care of the growing crop, the prevention and cure of crop diseases, and the harvesting, manipulation, and disposition of the crop when ripe. The raising of animals involves their selection and breeding, the feeding and care of the animals, attention to the numerous diseases to which they are subject, and the manipulation and disposition of animal products, including the art of dairying. In connection with both branches of agriculture, there is the general management of the farm and its equipment. For a history of

the development of agriculture in the various countries, see the article, **AGRICULTURE**.

I. For the general articles on the farm and its equipment, see:

- Farm Buildings
- Implements, Agricultural
- Farm Management
- Dry Farming

II. The preparation of the soil requires, first, the selection of a soil suited for the crop, and often its artificial fertilization; and, second, its tillage and irrigation.

For the selection of soil, see:

- Soil
- Humus
- Alkali Soils
- Chernozem
- Gumbo Soil
- Fallow
- Waste Lands
- Rotation of Crops

For fertilization and fertilizers, see:

- Chemistry, Agricultural

Fertilizers

Manures and Manuring

Green Manuring

Nitrification

Sewage Farming

Soil Amendments

Fish Manures

Bone Fertilizers

Guano

Marl

Compost

Gypsum

Poudrette

Lupine

Superphosphate

Thomas Slag

The processes of tillage are described under :

Tillage

Cultivator

Plow, Plowing

For the irrigation and drainage of the soil, see :

Irrigation

Drainage

Ditch

Mulch

Warping

Lysimeter

When the soil has been prepared and tilled, the seed is sown. See :

Seed Testing

Broadcasting

Drill

Harrow

When the crop is ripe, it is harvested and prepared for the market. See :

Harvest and Harvesting

Reapers, Reaping

Threshing

Hummeler

Fan, or Fanner

III. The principal crops which are the subjects of agriculture are, of course, the food plants, and of these the most important are the cereals. Other plants, however, aside from those which are the subjects of horticulture, are also regularly cultivated, such as forage plants (see under Stock-Raising below), and plants used for fibre and various other purposes.

For the principal cereals, see :

Cereals

Barley

Buckwheat

Maize

Millet

Oat

Rice

Rye

Wheat

Other food crops are :

Artichoke

Artichoke, Jerusalem

Bean

Beet

Cassava

Cowpea

Dolichos

Lentil

Pea

Potato

Pumpkin

Sago

Sorghum

Soy Bean

Sugar Beet

Sugar-Cane

Sweet Potato

(For vegetables and fruits, see under section on Horticulture.)

Plants cultivated for fibre are :

Behmeria

Cotton

Flax
 Hemp
 Hemp, Bowstring
 Hemp, Manila
 Hemp, Sisal
 Hemp, Sunn
 Henequen
 Ramie

Tobacco is also an important agricultural crop. See article TOBACCO.

IV. The care of the growing crop is of sufficient importance to have separate treatment, and the study and treatment of plant diseases is a science by itself. The principal cause of plant diseases are bacteria and fungi, and almost every kind of crop has its specific insect pests. These are all described in separate articles following the articles on the crops, under such titles as COTTON INSECTS, RICE INSECTS, etc., and, therefore, need not be enumerated here. The general articles on plant diseases and their treatment, and on diseases common to several crops are:

Diseases of Plants
 Fungicides
 Insecticides
 Insect Powder
 Mildew
 Blight
 Botrytis
 Canker
 Chlorosis
 Damping Off
 Dry Rot
 Ergot
 Gummosis
 Rust
 Smuts

The special diseases which affect particular crops are treated in the ar-

ticles on the separate crops, but a few are described in separate articles. See:

Bunt
 Cornstalk Disease
 Crown-Gall
 Ear Cockles
 Clubroot
 Oidium

Some of the common weeds with which the farmer and gardener have to contend are described in the articles:

Weed
 Burdock
 Chickweed
 Chufa
 Cockle
 Chenopodium
 Dodder
 Orache
 Pigweed
 Tare

V. The raising of live-stock is the second great department of agriculture, and involves the selection of the animals, their breeding and general care, a supply of the proper feed stuffs; attention to diseases, which constitutes the practice of veterinary medicine; and the preparation of the animal products for the market.

The most important animals raised as live-stock are described in the articles:

Horse
 Cattle
 Mule
 Sheep
 Goat
 Hog
 Poultry
 Fowl
 Duck
 Goose

Turkey

Pigeon

Bee

For the breeding and general care
of the animals, see:

Breeds and Breeding

Incubator

Horseshoeing

Hoof

Dehorning

Feeding Farm Animals

Soiling, Soiling Crops

Bee-Keeping

Feeding stuffs may be divided into
two general classes, natural or grow-
ing forage plants and the more or
less artificially prepared feeds. The
forage plants may again be divided
into grasses and those that are not
grasses, the latter being largely legu-
minous plants. See:

Feeding Stuffs

Pasture

Meadow

For forage grasses, see:

Grasses

Agropyron

Andropogon

Bermuda Grass

Blue Grass

Brome Grass

Buffalo-Grass

Canary-Grass

Crab-Grass

Gama Grass

Manna-Grass

Meadow Grass

Millet

Oat Grass

Orchard Grass

Redtop Grass

Rye-Grass

Sorghum

Teosinte

Timothy Grass

The principal forage plants other
than grasses are:

Alfalfa

Burnet

Chufa

Clover

Cowpea

Fescue

Lupine

Mangel-Wurzel

Medicago

Medick

Melilot

Rape

Sainfoin

Serradella

Soy Bean

Sulla

Trefoil

Vetch

For the most important prepared
feeds, see:

Brewers' Grains

Gluten Meal

Cottonseed Meal

Hay

Linseed Meal

Malt Sprouts

Silage

Farm animals are subject to numer-
ous serious diseases, and the investiga-
tion and treatment of these constitute
the profession of veterinary medicine.
A convenient subdivision of animal
diseases is according to the kinds of
animals which they affect, since, with
a few exceptions, each disease is either
peculiar to, or chiefly prevalent in, a
particular species. Several of these
given under cattle diseases, however,

may also affect horses or sheep, and vice versa.

(a) The general articles on the subject and those dealing with diseases common to several kinds of live-stock are:

Veterinary Medicine
Diseases of Animals
Abortion
Anthrax
Colic in Animals
Ring Worm
Mange
Tuberculosis (in animals)

(b) For diseases primarily affecting the horse, see:

Azoturia
Bighead
Canker
Curb
Fistula
Founder
Glanders
Heaves
Hoof
Influenza in Animals
Meningitis
Navicular Disease
Roaring
Strangles
Stringhalt
Spavin
Thrush

(c) For diseases of cattle, see:

Actinomycosis
Blackleg
Cattle Plague
Fardel-bound
Foot-and-Mouth Disease
Joint-Ill
Malignant Catarrh
Mammitis
Milk Fever

Red Water
Texas Fever

(d) For diseases of sheep, see:

Agalactia
Bloat
Braxy
Fardel-bound
Gid
Ictero-hæmaturia
Liver-Rot
Lung-Worms
Nodular Disease

(e) For a disease of hogs, see:
Hog Cholera

(f) For diseases of poultry and bees, see:

Blackhead
Gapes
Roup
Diarrhœa, White, of Chickens
Foul Brood

VI. In the preparation of animal products for the market, one of the most elaborate, as well as important, departments is that of Dairying. This industry involves the supply of milk and cream, and the manufacture of butter and cheese. For a general article on the subject and articles on the processes of manufacture, and the machinery and equipment of the dairy, see:

Dairying
Milking Machine
Aëerator
Creamery
Separator
Butter-Making
Churn
Butter-Worker
Butter-Color
Cheese-Making

Cheese Factory
Rennet

For the principal dairy products,
see:

Milk
Skim Milk
Casein
Cream
Butter
Cheese
Buttermilk
Milk Sugar (under Sugars)
Ghee
Kephir
Koumiss
Whey

VII. Other more or less direct products of agriculture and stock raising, and the methods of their disposal, are described under:

Market and Marketing
Flour
Farina
Semolina
Food
Bread
Sugar
Honey
Glucose
Meat
Pork
Leather
Wool

See also **POULTRY** and **EGG** and the articles there referred to.

VIII. Since the patriarchal stage, Agriculture has been regarded as the most important of human industries, and is the one which has especially received direct and official attention from the governments of civilized nations. There are also at present numerous educational institutions, and private or semi-public associations for the advancement of the industry. See:

Agriculture, U. S. Department of
Agricultural Experiment Station
Agricultural Education
Farmers' Institute
Agricultural Association
Grange

IX. For biographies of eminent agriculturists, see:

Atwater, W. O.
Brewer, W. H.
Goodell, H. H.
Harris, J.
Hellriegel, H.
Hilgard, E. W.
Holdefleiss, F. W.
Johnson, S. W.
Judd, O.
Lawes, J. B.
Maercker, M.
Morris, Daniel
Ruffin, E.
Thaer, A. D.
True, A. C.
Wallace, R.
Young, A.

B. Horticulture and Forestry

Horticulture is the art of producing plants which are valued for their agreeable properties rather than as necessities for human comfort. The horticultural methods of breeding,

propagating, and cultivating plants differ essentially from the agricultural method in that great attention is paid to the individual plant, while in agriculture attention is given to the crop

as a whole, in which the individual is lost. The subjects and products of horticulture are flowers, ornamental shrubs and trees, fruit trees, plants used as condiments, vegetables for the table, when considered merely as accessories to the more substantial articles of food, and all other plants treated by horticultural methods.

Horticulture also concerns itself with the laying out of gardens, and in this field of its activity it merges into landscape gardening and forestry. The latter, however, is a purely economic art and is not a branch of horticulture. It is included in this section because it is not yet a highly complex art and is, therefore, treated in a few general articles. For the general articles on Horticulture and Forestry, see:

- Horticulture
- Floriculture
- Landscape Gardening
- Arboriculture
- Forestry
- Afforestation

I. The buildings and equipments used by the horticulturist are described in the articles:

- Greenhouse
- Hothouse
- Conservatory
- Frame
- Espalier
- Hoe

One of the principal aims of horticulture is to develop particularly desirable varieties of plants and to maintain them true to the stock. For this purpose, special methods of breeding and propagation are necessary. See:

- Plant-Breeding

- Nursery
- Budding
- Cutting
- Grafting
- Layering
- Caprification

Special methods are also necessary in raising the young plants to maturity and securing the desired qualities in the matured product. See:

- Forcing
- Bottom Heat
- Electro-culture of Plants
- Pruning
- Cordon
- Blanching

For the most important plants cultivated in greenhouses, see:

- Greenhouse Plants
- Achimenes
- Azalea
- Banksia
- Carnation
- Chrysanthemum
- Fuchsia
- Gardenia
- Gladiolus
- Hyacinth
- Lily, Lily of the Valley
- Mignonette
- Oleander
- Passion-Flower
- Pelargonium

II. The principal articles on gardens, ornamental shrubs, and garden plants are:

- Lawn
- Hedge
- Ampelopsis
- Azalea
- Canna
- Centaurea
- Chrysanthemum

Convolvulus
Cosmos
Cotoneaster
Cowslip
Dahlia
Eschscholtzia
Heliotrope
Hibiscus
Hollyhock
Hyacinth
Hydrangea
Ivy
Jasmine
Jonquil
Laburnum
Larkspur
Laurustinus
Lavender
Libocedrus
Lilac
Lily
Lily of the Valley
Mignonette
Narcissus
Peony
Petunia
Phlox
Pink
Polyanthus
Poppy
Rose
Star of Bethlehem
Sunflower
Sweet Pea
Thrift
Tropæolum
Trumpet Flower
Tuberose
Tulip
Wallflower
Wistaria

Fruit, Cultivated
Orchard
Apple
Apricot
Banana
Blackberry
Butternut
Calville
Cherimoyer
Chestnut
Cranberry
Currant
Custard-Apple
Date
Dewberry
Earthnut
Fig
Gooseberry
Grape
Hazelnut
Huckleberry
Kumquat
Lemon
Lime
Litchi
Loquat
Mango
Melon
Mulberry
Muskmelon
Olive
Orange
Peach
Peanut
Pear
Persimmon
Pineapple
Plum
Pomegranate
Quince
Raspberry
Strawberry
Walnut
Watermelon

III. For the principal articles on
fruit trees and fruit culture, see:

For table vegetables, see:

Vegetables
Herbs, Culinary
Salad Plants
Asparagus
Brussels Sprouts
Cabbage
Carrot
Cauliflower
Celery
Corn-Salad
Cress
Cucumber
Egg Plant
Endive
Garlic
Kale
Kohl-rabi
Leek
Lettuce
Mushroom
Onion
Parsley
Parsnip
Radish
Rhubarb
Salsify
Spinach
Squash
Tomato
Truffle
Turnip

V. For the principal plants cultivated for their flavoring qualities, see:

Flavoring Plants
Allspice
Almond
Capsicum
Caraway
Chicory
Chive
Cinnamon
Citron

Cloves
Fennel
Hop
Horseradish
Mace
Mustard
Nutmeg
Pepper
Pistacia
Thyme
Vanilla

VI. The section on horticulture should also include reference to the articles on the well known beverage plants, and on some of the more direct products of horticulture. See:

Coffee
Tea
Cacao
Wine
Cider
Prune
Raisins

VII. For biographies of eminent horticulturists and foresters, see:

Bailey, L. H.
Burbank, L.
Downing, A. J.
Downing, C.
Duhamel du Monceau
Henderson, P.
Hess, R.
Heyer, G.
Heyer, K. J.
Hovey, C. M.
Kenrick, W.
Koristka, K. von
Landreth, D.
Lodeman, E.
Longworth, N.
Loudon, J. C.
Lyon, T. T.
Manning, R.

See also HORTICULTURAL SOCIETIES.

Chapter 27. Zoology

EVERY topic of importance in Natural History, especially as represented in America, is contained in the pages of the *New International Encyclopædia*, which thus may justly be called a complete text-book of zoölogy. The outline of our knowledge of animal life thus furnished is supplemented, in respect to each part of it, by references to special books, museum collections, and other sources of knowledge where the student may find the minute details and investigations interesting and necessary to the specialist, but superfluous to a general reader. The material contained in the Encyclopædia is thus equally useful to the deep and to the superficial inquirer; for the specialist in one department of science needs to have at hand general information, at least, as to other departments.

Zoölogy has two aspects: (a) that of its observed facts; and (b) that of the principles involved: phenomena and deductions; condition and theory. The foremost or basic part is a knowledge of the facts of the animal world, namely: Form and Structure; Reproduction, Embryology and Growth; Habit; Instinct; Distribution, past and present; Relationship, of animals to one another, and to their environment. From these have been deduced the facts of the Classification and Evolution of forms.

STRUCTURE.

The reader who seeks to take the topics dealing with Form and Structure in order may read the following articles:

Biology
Morphology
Animal
Protoplasm
Cell
Amœba
Embryology
Anatomy
Bone

Skeleton; and the more particular accounts of its component parts, as SKULL, HAND, SHOULDER-JOINT, etc.

Muscular System
Circulatory System
Alimentary System
Excretory System
Respiratory System
Nervous System and Brain

Cephalization
Metamerism
Integument
Horn
Hoof
Nail
Teeth
Hair
Feather
Pterylosis
Scales
Pigment
Metachrosis
Chromatophore
Melanism
Touch
Taste
Smell
Eye
Ear

The structure of various animals, as characteristic of groups, is given in such general articles as:

Amblypoda

Ammonites
 Amphibia
 Annulata
 Arachnida
 Archæopteryx
 Bat
 Beetle
 Bird
 Bovidæ
 Butterflies and Moths
 Brachiopoda
 Camelidæ
 Canidæ
 Carnivora
 Cephalopoda
 Cestoda
 Chordata
 Cœlenterata
 Coral
 Crinoidea
 Crustacea
 Deer
 Dinosauria
 Dipnoi
 Echinodermata
 Elasmobranchii
 Electric Fish
 Felidæ
 Fish
 Fly
 Fringillidæ
 Frog
 Ganoidei
 Gastropoda
 Holothurian
 Horse, Evolution of the (under
 Horse, Fossil)
 Hydrozoa
 Hymenoptera
 Infusoria
 Insect
 Mammalia
 Marsupialia
 Medusa

Mollusca
 Ophiuroidea
 Prototheria
 Protozoa
 Pterodactyl
 Pteropoda
 Reptile
 Rodentia
 Sirenia
 Snake
 Turtle
 Ungulata
 Vertebrata

For the most part, the articles referred to contain, incidentally or cited in the appended Bibliography, the names of investigators identified with these particular subjects. In the great majority of cases the biography of each of these men is to be found in its alphabetical position in the *Encyclopædia*; and an earnest reader will turn to it, and so acquaint himself with the man by whose learning he is profiting.

REPRODUCTION AND GROWTH.

Animals continue to exist by reproducing their kind after various methods, and each individual passes through a more or less complicated series of changes from its beginning to its maturity, collectively known as its life-history, or autogeny. An orderly study of this essential phase of animal life may be conducted by reading the articles mentioned below, with the lesser ones indicated by cross-references:

Reproduction
 Spontaneous Generation
 Egg
 Spermatozoön
 Gemmule
 Sex
 Embryology

Fœtus
Epigenesis
Mitosis
Parthenogenesis
Alternation of Generations
Biogenesis
Cross-fertilization
Metamorphosis
Larva
Pupa
Metabolism
Growth
Regeneration
Heredity
Pangensis
Prepotency
Telephony
Mendel's Law
Breeds and Breeding
Hybridity
Nidification

HABITS.

The habits of animals constitute the principal feature of what may be called Descriptive Zoology—that is, accounts of a species or a group of species placed under the vernacular name. This policy has been adopted, rather than that of putting descriptions under technical names, for greater convenience of reference, as well as to avoid that attitude of pedantry which made the earlier encyclopædias often ridiculous. The majority of readers would turn more naturally to HORSE than to “Equidæ” or to BLACKSNAKE than to “Zamenis.” The technical characteristics of many of the larger groups, lacking any English appella-tive, are given under their term in classification, as PROTOZOA, BOVIDÆ, and the like, or sometimes under the name of the special science dealing

with them, as ICHTHYOLOGY, OËNI-THOLOGY. Habits of animals, then, may be learned from the descriptive articles generally, the principal of which are given below:

Agate Shell
Agouti
Albatross
Alewife
Alligator
Anaconda
Ani
Ant
Antelope
Ant-lion
Aoudad
Apteryx
Armadillo
Ass
Auk
Aurochs
Axolotl
Aye-aye
Baboon
Badger
Bandicoot
Bank swallow
Barn-owl
Barn-swallow
Bass
Bat
Bear
Beaver
Bedbug
Bee
Bighorn
Bird of Paradise
Bison
Bittern
Blackbird
Blacksnake
Bluebird
Bluefish
Boa

Bobolink
Bollworm
Bookworm
Bot
Bower-bird
Brant
Buffalo-bird
Bug
Bulbul
Bumblebee
Bunting
Bushmaster
Bustard
Butterfish
Butterflies
Buzzard
Caddis-fly
Camel
Capercaillie
Capybara
Caribou
Carp
Carpenter Bee
Cat
Cattle
Cave Animals
Cavy
Chameleon
Chamois
Chinch-bug
Cicada
Civet
Clam
Clothes-moth
Cockatoo
Cockroach
Cod
Conch
Condor
Copperhead
Cowbird
Coyote
Crab
Cricket

Crocodile
Crow
Cuckoo
Curlew
Death Adder
Deathwatch
Deer
Devilfish
Dingo
Dodo
Dog
Dove
Dragon-fly
Duck
Duckbill
Dugong
Duiker
Eagle
Earthworm
Eel
Eider
Elephant
Electric Fish
Ermine
Falcon
Fer-de-lance
Firefly
Fish-hawk
Flamingo
Flea
Flesh-fly
Fly
Fly-catcher
Flying Squirrel
Fox
Frog
Gall-insects
Gannet
Garefowl
Gazelle
Gibbon
Gipsy Moth
Giraffe
Gnat

Goat	Lamprey
Goldfinch	Land Tortoise
Goose	Leech
Gopher	Lemming
Gorilla	Lemur
Goshawk	Leopard
Grayling	Lion
Grebe	Lizard
Grouse	Llama
Guanaco	Lobster
Gull	Lory
Halibut	Louse
Hare	Lungfish
Hawk	Mackerel
Hedgehog	Mallard
Hermit Crab	Mammalia
Heron	Mammoth
Herring	Manatee
Hessian Fly	Man-eater Shark
Hippopotamus	Marsh Hawk
Hognose	Marten
Hook-worm	Maskinonge
Hornbill	Mastodon
Horse	Menhaden
Hound	Mole
House-fly	Mollusk
Humming-bird	Monkey
Hyena	Moose
Ibex	Mosquito
Ibis	Moth
Iguana	Mouse
Jackal	Mule Deer
Jackdaw	Mungoos
Jaguar	Musk Ox
Jay	Muskrat
Jelly-fish	Narwhal
Jungle Fowl	Nest
Kangaroo	Nightingale
Katydid	Nightjar
King-bird	Nurse-frog
Kingfish	Nutria
Kingfisher	Opossum
Kraken	Orang-utan
Lace-bug	Oriole

Ostrich	Sardine
Otter	Sawfish
Owl	Scale Insect
Oyster	Scorpion
Palolo Worm	Sea-anemone
Parrakeet	Sea-bass
Parrot	Sea-horse
Partridge	Seal
Peacock	Sea-otter
Pheasant	Sea-urchin
Pigeon	Shark
Pipa	Sheep
Pipefish	Sheepshead
Plant-bug	Shore-birds
Plover	Shrew
Polecat	Shrike
Pompano	Shrimp
Porcupine	Silkworm
Porpoise	Skunk
Potato Insects	Skylark
Prairie Dog	Sloth
Ptarmigan	Smelt
Puma	Snail
Python	Snake
Quagga	Snipe
Quail	Spaniel
Quinnat Salmon	Sparrow
Rabbit	Spider
Raccoon	Sponge
Rail	Sporozoa
Rat	Squid
Rattlesnake	Squirrel
Raven	Starfish
Ray	Stickleback
Rhinoceros	Stork
Road-runner	Sturgeon
Robin	Sunfish
Rocky Mountain White Goat	Swallow
Roe Deer	Swan
Rook	Swift
Sable	Swine
Salamander	Tailor-bird
Salmon	Tanager
Sandpiper	Tapeworm

Tapir
Tarantula
Tautog
Termite
Terrapin
Terrier
Thread-worms
Thrush
Tick
Tiger
Tiger-hunting
Tilefish
Titmouse
Toad
Toucan
Tree-frog
Trogon
Trout
Tsetse-fly
Turbot
Turkey
Turtle
Umbrella-bird
Vampire
Veery
Viper
Vireo
Viscacha
Vulture
Walrus
Wapiti
Warbler
Wasp
Watersnake
Water-spider
Water-thrush
Wax-insect
Weakfish
Weasel
Weaver-bird
Weevil
Whale
Whippoorwill
Wildcat

Wolf
Woodpecker
Wood-rat
Worm
Wren
Yak
Zebra

MIND IN ANIMALS.

The intelligence and mental processes of animals are subjects to which much attention has been paid recently, and facts bearing upon them are eagerly sought. Some of the conclusions of students will be found in the following:

Ant

Nervous System, Evolution of the
Habit

Instinct

Social Insects (under Insect)

Orientation

DISTRIBUTION OF ANIMALS.

Everyone is aware that different parts of the earth's surface have different faunas, and that this condition apparently remains permanent, except when, by means of civilization or commerce, certain animals are enabled to spread beyond their natural habitat, and even become cosmopolitan, as have rats, house-mice, the European house-sparrow, and a large number of plant-feeding insects. Normally one fauna does not enlarge or diminish at the expense of another, and, for the most part, species of animals, as of plants, are restricted to a comparatively small range and set of climatic conditions. The local faunas, both on the land and in the sea, have been examined, and their boundaries well ascertained. It has been found, however, that groups of related faunas

exist side by side, which may be composed into large divisions called "sub-regions," and these into a few still larger ones called "regions." The natural barriers which are set to the dispersion of animals, and the finding of the actual boundaries of the faunal districts, form the outlines of the highly interesting study of the geographical distribution of animal life, past and present. To acquaint himself with this science, the reader should peruse the following co-related articles:

Distribution of Animals
Fauna
Ethiopian Region
Paleotropical Region
Holarctic Region
Nearctic Region
Oriental Region
Palearctic Region
Deep-sea Exploration
Pelagic Animals
Plankton

See also the names of the various subregions, as **NEW ZEALAND SUB-REGION**, **MALAGASY SUBREGION**, etc.; the paragraphs on *Fauna* under the names of the various continents and countries, as **AMERICA**, **AUSTRALIA**, **BRAZIL**, and the like; and, for the distribution of animals in past ages, **PALEONTOLOGY**, **EXTINCTION OF SPECIES** and **MIGRATION OF ANIMALS**.

RELATIONSHIP.

The relationship of animals toward others, and to the environment of each individual, species, or group, forms a feature of far-reaching importance and of great interest in zoology, and the study of the facts involved has been set apart as a science under the name of **BIONOMICS**. Much relating to it

will be found in the descriptive articles cited under **Habits** and elsewhere, but special consideration is given under the succeeding heads:

Bionomics
Cave Animals
Environment
Estivation
Flowers and Insects
Hibernation
Social Insects (under Insect)
Natural Selection
Orientation
Parasite
Symbiosis
Tropism

The relations between man and the lower animals are mainly those of warfare or service. Animals are in the way of his operations or dangerous to him, and must be got rid of, or supply him with flesh, or hide, or fur, or some other desirable thing, which can be obtained, in most cases, only by killing them; or they attract him to the chase and to such sports as angling and shooting. Hence, many are sought only to be killed, and some species have been entirely exterminated. On the other hand, his agricultural operations have encouraged the spread and development of some, as various insects, rats, etc., in a remarkable way. A third class has been utilized by domestication and turned to his service and benefit. Some articles of special moment in the *Encyclopædia* dealing with this sporting and economic aspect of natural history are these:

Acclimatization
Angling
Bee
Buffalo

Domestic Animals (and the various kinds, as Camel, Cat, Dog, Horse, Sheep, Fowl, etc.)

Extinct Animals

Falconry

Fish as Food

Fish Culture

Fisheries

Fishing

Fur and the Fur Trade

Game Laws

Game Preserve

Insects, Propagation of Disease by

Introduced Species (especially of injurious insects, such as those described under Bollworm, Cutworm, Chinch-bug, Pear Insects, etc.)

Mosquito

Oyster

Pearl

Prairie Dog

Rabbit

Seal

Silkworm

Taxidermy

METHODS OF STUDY.

The methods of study in natural history are described to some extent in the articles:

Deep-sea Exploration

Laboratory

Microscope

Morphology

Nature-Study

Psychological Apparatus

Zoölogical Garden

Zoölogical Station

CLASSIFICATION OF ANIMALS.

Turning now from the methods and facts of observation and experiment to the philosophical deductions,—the principles and theories drawn from these

facts,—the reader will first need to attend to the subject of classification, which has been slowly developed through a long series of errors and limitations and gradually corrected in the brightening light of growing knowledge. The history of this search for the true, because natural, classification may be found in the articles ANATOMY, CLASSIFICATION OF ANIMALS, and ZOÖLOGY, with the names of the men who from time to time notably advanced taxonomy, and whose biographies may be read. No real success was achieved until the modern conviction was arrived at, that the key to the problem of classification was to be found in community of descent, and that any true classification must follow the perception of genetic relationship—descent from a common ancestor. This is the basis of modern classification, and what we have approaches perfection in just the degree that the phylogeny of each group is rightly apprehended. As a result of the constant increase of knowledge, the arrangement of this group and that is constantly being modified and presumably always improved. From time to time, these amendments are gathered up and critically combined into a general scheme. The latest such scheme of classification of the whole animal kingdom, which is authoritative and at the same time generally accessible, is that contained in Parker and Haskell's *Text-book of Zoölogy*, and this has been followed in respect to the general outline in this Encyclopædia, insuring uniformity. For further details, consult:

Classification of Animals

Phylogeny

Variation**Type****Zoology**

For the classification of separate groups, see their titles, as CœLENTERATA, CRUSTACEA, MOLLUSCA, ECHINODERMATA, etc.

ZOOLOGY AND EVOLUTION.

The philosophical part of zoology has been developed since man began to observe the ways of nature, and has produced a vast body of "laws," doctrine, and speculation, the history of which is sketched in such general articles as ANATOMY, ZOOLOGY, EVOLUTION, etc., and the biographies of the great thinkers cited should be read in connection with their themes. Science has constantly tended to separate itself from metaphysics, and to use its hypothesis merely as a means for further investigation of phenomena. The outcome has been the formulation and general acceptance of a theory of universal development from the simple to the complex, from the homogeneous to the specialized; and Organic Evolution or the Doctrine of Descent is the application of the general principle to the history and phenomena of living things. A reader who wishes to acquire a knowledge of these views of nature may do so by reading in consecutive order the articles named below:

Biology**Evolution****Ontogeny****Phylogeny****Natural Selection****Lamarckism****Growth****Heredity****Hybridity****Mendel's Law****Extinction of Species**

Guided by these articles and the cross-references to be found in them, he may pursue the subject under other fruitful titles, such as:

Botany**Chromosomes****Cross-fertilization****Degeneration as a Factor in Evolution****Embryology****Environment****Flowers and Insects****Isolation****Kinetogenesis****Longevity****Mechanics of Development****Mimicry****Neo-Darwinism****Neo-Lamarckism****Otter Sheep****Pollination****Polymorphism****Protective Coloration****Recognition Marks****Regeneration****Reversion****Senescence****Sex****Sexual Selection****Use-Inheritance****Variation****Warning Coloration****Weismannism****BIOGRAPHY.**

Only a name or two has been quoted in the preceding analysis of the science of zoology. The investigators in the field have been numerous, and the following list should be regarded as selected rather than complete. See:

Agassiz, L.

- Audubon, J. J.
Baer, K. E.
Baird, S. F.
Balfour, F. M.
Barry, M.
Bates, H. W.
Beecher, C. E.
Bennett, J. H.
Bichat, M. F. X.
Blumenbach, J. F.
Bory de Saint Vincent, J. B.
Burbank, L.
Burmeister, H.
Camper, P.
Carus, K. G.
Castelnau, F.
Clark, H. J.
Cope, E. D.
Coste, J. V.
Cuvier, G. L. C.
Dana, J. D.
Darwin, C.
Davenport, C. B.
Degeer, K.
Dohrn, A.
Du Bois-Reymond, E. H.
Dujardin, F.
Eimer, T.
Eschscholtz, J. F.
Fleming, J.
Flourens, M. J. P.
Forel, A.
Galton, F.
Gay, C.
Gegenbaur, K.
Geoffroy Saint-Hilaire, E.
Gesner, K.
Goode, G. B.
Gould, A. A.
Gould, J.
Graaf, R. de
Green, S.
Haeckel, E.
Haller, A.
Harvey, W.
Hertwig, O.
Hertwig, R.
Huber, F.
Humboldt, A.
Hunter, J.
Huxley, T. H.
Hyatt, A.
Jordan, D. S.
Köl liker, A.
Lamarck, J. B.
Lang, A.
Lankester, E. R.
Le Conte, L.
Le Conte, J. E.
Le Conte, J. L.
Leeuwenhoek, A.
Leidy, J.
Lesueur, C. A.
Leuckart, R.
Levaillant, F.
Leydig, F.
Linnæus, C.
Loeb, J.
Lubbock, J.
Lyonnet, P.
Malpighi, M.
Marsh, O. C.
Mendel, G. J.
Mivart, St. George
Müller, J.
Müller, J. F. T.
Orbigny, A. D. d'
Osborn, H. F.
Owen, Richard
Packard, A. S.
Pallas, P. S.
Perty, J. A. M.
Ray, J.
Réaumur, R. A. F.
Reimarus, H. S.
Romanes, G. J.
Ross, A. M.
Roux, W.

Schleiden, M. J.
Schultze, M. S.
Schwann, T.
Sedgwick, W. T.
Semper, K.
Siebold, K. T. E.
Spallanzani, L.
Spencer, H.

Swammerdam, J.
Tschudi, J. J.
Vries, H. de
Wagner, M.
Wallace, A. R.
Weismann, A.
Wilson, A.
Wyman, J.

28. Manufactures and Engineering

THE development of manufacturing industries has resulted from more efficient economic organization, and from the perfection of technological processes involving the application of scientific discoveries and knowledge. Accordingly, the most profitable method of study is first to consider the development of manufactures in general from the economic standpoint, and especially of the Factory System, where concentration permits of manufacture in increased quantities at diminished expense. This will be found treated in the articles on **FACTORIES** and **MACHINERY**, **ECONOMIC EFFECTS OF**, in which is traced the growth of manufacturing in general. For specific industries, reference should be made to the separate articles, as the historical and statistical development of any given industry is best considered by itself, on account of the important relation that it bears to practical questions of material, processes, and the like. This brings us straightway to the leading question how things are made, which it is an important function of an encyclopædia to answer. In this is involved the gathering and preparation of the raw material, the manufacture, the finishing, and the distribution, or utilization, of the finished product. There are prepared below a number of lists of subjects, more or less cognate, dealing with manufacturing industries and their products, and, by carefully observing the cross-references, a complete idea of the more important processes may be gained.

A. Manufacturing Processes

FOOD AND MANUFACTURE OF FOOD STUFFS, ETC.

An important field of manufacturing operations is that concerned with the preparation of food stuffs, both in the factory and on a less extensive scale in the home. **COOKERY**; **FOOD, PRESERVATION OF**; **SLAUGHTER HOUSES**; and **PACKING INDUSTRY** are titles that suggest the wide range of subjects that may be grouped under such a head. The following list indicates appropriate titles:

Meat
Slaughter Houses
Packing Industry
Food, Preservation of
Digester

Extract of Meat

Ham
Lard
Tallow
Pemican
Jerked Beef
Cookery
Wheat
Flour
Baking
Bread
Biscuit
Baking Powder
Butter
Cheese
Guarana
Macaroni
Sugar
Sardine

Gelatin
Confectionery
Chocolate
Cocoa Butter
Chewing Gum
Macaroon
Condiments
Pickles
Chutnee
Curry Powder
Olive Oil

Alcohol, Physiological and Poisonous Action of

Fermentation

Brewing

Beer

Wine

Currant Wine

Distilled Liquors, or Ardent Spirits

Distillation

Brandy

Apple Brandy

Rum

Whisky

Fusel Oil

Geneva

Gin

Liqueur

Absinthe

Benedictine

Chartreuse

Curaçoa

Kirsch

Kümmel

Maraschino

Ratafia

Noyau

Bishop

Cider

Berlin Spirit

Bottling and Bottling Machinery

FIBRES AND TEXTILES.

FERMENTED AND DISTILLED LIQUORS.

The manufacture of **BEER**, **WINE**, and **LIQUORS** involves many interesting processes in chemical technology. A convenient beginning may be made by considering the history of fermented and distilled liquors, and the extent to which they are manufactured and consumed. Then, taking up the general properties of beer, wine, and distilled liquors, a classification of these beverages can be made, and the essential features of their production learned. Further details appropriate to the manufacture are discussed under **BREWING**, **STILL**, **BOTTLING AND BOTTLING MACHINERY**, while questions involving the chemistry of the subject are treated under **FERMENTATION**, **DISTILLATION**, and **ALCOHOL**. The physiological effects of alcohol are not only interesting, but instructive, and are properly considered in connection with the manufacture of alcoholic beverages. For a comprehensive study of the whole subject, the following articles should be consulted:

Liquors, Fermented and Distilled,
Statistics and History of
Alcohol
Alcoholometry
Hydrometer

The subject of fibres and textiles is one of novel scope and, for its proper comprehension, requires first the consideration of the fibres themselves and how they are produced and prepared for manufacture. The chief vegetable fibres are;

Cotton
Flax
Hemp
Jute
Linen
Hemp, Manila

Ramie
 Coir
 Cotton, Artificial
 Wood Pulp Yarns
 Silk
 Silk Worm
 Floss Silk
 Organzine
 Wool
 Wool and Worsted Manufactures
 Sheep
 Noils
 Shoddy

It is next advisable to consider the processes by which the fibres are prepared for spinning and weaving. These processes are discussed in the following articles:

Cotton-Gin
 Heckle
 Carding
 Spinning
 Yarn

Textile manufacturing comprises industries of many diverse characters, which employ complicated machinery. As they have a certain amount of similarity, and bear some relation to each other, the processes of making the various fabrics may first be considered together. The first step is the designing of the fabric, in which the weaves, patterns, and designs are made on the Loom. This naturally involves the discussion of WEAVING, which should explain the fundamental weaves and the methods by which patterns are produced. Therefore, in this connection, the following articles should be consulted:

Textile Manufacturing
 Textile Designing
 Weaving
 Loom

Heddle
 Bobbin

Crocheting and knitting differ essentially from weaving and, whether performed by hand or machine, are the means of producing garments and other useful articles. The following titles indicate the articles to be consulted on these subjects:

Crochet
 Knitting
 Hosiery

Either the yarn or the finished fabric may be dyed, or the latter may be printed, in order to impart colored designs to it. In either case, complex and interesting processes are involved, which are described in the list below:

Dyeing
 Coal-Tar Colors
 Vegetable Colors
 Indigo
 Turkey Red
 Textile Printing
 Beetling
 Calendering
 Bleaching
 Bleaching-Powder
 Embroidery

The finished textile fabrics are almost infinite in their variety. It is possible to select the more important and the representatives of the leading classes and study them in detail. Such a list arranged alphabetically is as follows:

Art Square
 Bandana
 Barege
 Batiste
 Blanket
 Bobbinet

Bolting-Cloth

Bombazine

Brocade

Brocatel

Brussels Lace

Buckram

Bunting

Cambric

Camel's Hair

Camlet

Canvas

Carpet

Cassimere

Chenille

Chintz

Corduroy

Crape

Cretonne

Crinoline

Damask

Diaper

Dimity

Dornick

Drugget

Duck

Felt

Flannel

Floor-Cloth

Fustian

Galloon

Gauze

Gingham

Grass Cloth

Gunny

Haircloth

Huckaback

Kersey

Lace

Linen

Matting

Mercerized Cotton

Mohair

Moire

Moleskin

Muslin

Nankeen Cloth

Nets

Oilcloth

Piña Cloth

Plush

Poplin

Rugs

Satin

Silk

Taffeta

Tapestry

Tarlatan

Tweed

Velvet

LEATHER AND LEATHER MANUFACTURES.

The various processes for the manufacture of LEATHER are described under that title, and the finished products, such as boots, shoes, saddlery, etc., in which independent industries participate, are appropriately grouped by themselves. For leather and leather goods, the following list is recommended:

Leather

Bark

Tanning (under Leather)

Buckskin

Glove

Buff Leather

Cordovan

Shagreen

Chamois

Leather Cloth

Saddlery

Boot

Shoes

Blacking

CARRIAGES AND OTHER VEHICLES.

From the primitive ox-cart to the

modern motor vehicle in its numerous forms for business and pleasure is a long step, and it includes the development of many vehicles that have wrought important economic and social changes, involving new and improved road construction. These are represented in the following list:

- Cart
- Chariot
- Carriage
- Coach
- Driving
- Coupé
- Hansom Cab
- Wagonette
- Buckboard
- Phaeton
- Ambulance
- Bicycle
- Automobile
- Motor Vehicle
- Motor Cycle
- Side Car

CERAMIC INDUSTRIES.

Clay affords the fundamental material for numerous products used in industry and also for works of art. From its geology to its decorative application many interesting processes are involved, and the reader will find the subject well covered in the *NEW INTERNATIONAL ENCYCLOPAEDIA*. It is recommended that at the outset the article *CLAY* be studied, followed by those on the accompanying list which discuss rather the industrial uses as somewhat distinct from the mere artistic, as contained in the next following section:

- Clay
- Kaolin
- Kiln

- Fire Brick
- Fire Clay
- Pipe Clay
- Pottery
- Tile
- Terra Cotta
- Fireproof Construction

PORCELAIN AND POTTERY.

There are few more interesting studies than that of porcelain and pottery, and, if the processes are traced from the production of the clay until the finished piece emerges from the kiln after the final firing, the reader will be well repaid. For this purpose the following articles are recommended:

- Pottery
- Porcelain
- Biscuit
- Kiln
- Annealing
- Ceramic
- Enamel
- Bow China
- Burmese Ware
- Vase
- Cracklin
- Stoneware (under Delft)
- Delft Ware
- Eggshell China
- Faience
- Jasper Ware
- Majolica
- Terra Cotta
- Tile
- Pyrometer

GLASS.

Few materials are more extensively employed in the arts than glass, and in scientific work and in decoration it also holds an important place. For the es-

sential features of its manufacture, the comprehensive and general article **GLASS** should be consulted, while the subordinate topics, as listed below, should be read in this connection:

Glass
 Flint Glass
 Crown Glass
 Iridescent Glass
 Water-Glass
 Wire Glass (under Glass)
 Bottle
 Carboy
 Prince Rupert's Drops
 Bologna Vial
 Lens
 Mirror
 Lorraine Glass
 Stained Glass
 Gems, Imitation

HOROLOGY.

The construction of various instruments for keeping time is a science of considerable antiquity, and its various departments may be studied with profit. A convenient arrangement of titles is given below:

Horology
 Clock
 Watch
 Clepsydra
 Dial
 Hour-Glass
 Balance
 Escapement
 Fusee
 Pendulum
 Isochronism
 Chronoscope
 Chronograph
 Time, Standard
 Time Signals

PRINTING, TYPOGRAPHY, ENGRAVING, PAPER, ETC.

The development of the art of printing has brought about many connected processes and industries. These are concerned with the impression on paper of letters or designs in one form or another, or the provision of the apparatus and machinery to do this, as well as the material to receive the impression. An arrangement of such subjects is as follows:

Printing
 Case
 Type Founding
 Typesetting Machines
 Electrotyping (under Electro-Chemistry, Industrial)
 Bank Notes, Manufacture of
 Engraving
 Photo-Engraving
 Three-Color Process
 Lithography
 Rotogravure
 Ink
 India Ink
 Graphotype
 Paper
 Parchment
 Parchment, Vegetable
 Cardboard
 Bristol Board
 Cartridge-Paper
 Calendering
 Bookbinding
 Envelope
 Pen
 Fountain Pen (under Pen)
 Pencil
 Typewriters
 Copying Machines
 Sealing-Wax
 Ruling Machine

MISCELLANEOUS INDUSTRIES AND PRODUCTS.

Bead
 Bell
 Blacking
 Bristles
 Brush and Broom
 Button
 Candle
 Celluloid
 Coal-Tar
 Coke
 Comb
 Cooperage
 Cork
 Corset
 Cosmetics
 Doll
 Embossing
 Excelsior
 Fan
 Flowers, Artificial
 Gems, Imitation and Artificial
 Gilding
 Gimp
 Glove
 Glue
 Gold Lace
 Grease
 Gutta-Percha
 Ivory
 Ivory, Vegetable
 Japanning
 Jewelry
 Lac
 Lacquer-Work
 Lapidary Work
 Laundry Machinery
 Linoleum
 Lumber Industry
 Mangle
 Matches
 Needle
 Ormolu

Papier-Maché
 Pen
 Pencil
 Perfumery
 Petrolatum
 Pin
 Poppy-seed Oil
 Pyrotechny
 Rope
 Rubber
 Sawdust
 Sewing Machine
 Silkworm Gut
 Straw Manufactures
 Tableware, Silver-Plated
 Tobacco Pipe
 Vacuum Cleaners
 Varnish
 Voting Machine

MINING AND METALLURGY.

In addition to general articles on MINING and METALLURGY, there will be found, under the various metals, articles dealing not only with their occurrence and general properties, but also with their mining and metallurgy. Such articles are included in the following list:

Mining
 Metallurgy
 Iron and Steel
 Copper
 Gold
 Silver
 Nickel
 Zinc
 Platinum
 Lead
 Tin
 Antimony
 Manganese
 Mercury
 Aluminium

Cobalt
Molybdenum
Lithium
Tungsten
Uranium
Vanadium

Looking, however, at special methods of mining and metallurgy, there are general articles which have reference to the more common metals and the methods of producing and refining them. These articles are as follows:

Mining
Mines and Mining in Law
Blasting
Explosives
Mine Accidents
Assaying
Metallurgy
Metallography
Calcining
Crucible
Ore Dressing
Roasting
Chloridizing
Chlorination
Refining of Metals
Electro-Chemistry
Electric Furnace

Although considerable material on metal working is given under the metals themselves, there are certain processes which can be described in special articles. These include the following:

Founding
Forge, Forging
Anvil
Welding
Tempering Steel
Annealing
Dies and Die-Sinking

Damaskeening
Brazing
Rolling Mill
Grinding and Crushing Machinery
Mint
Draw-Plate
Electro-Plating
Metal-Working Machinery

For many purposes, alloys are more useful than simple metals. These are discussed under their own heads, as well as in a collective article, while other preparations of metal, as GALVANIZED IRON and STEEL WOOL are also treated. A list of such articles is as follows:

Alloy
Alloys Magnetic
Brass
Bronze
Babbitt Metal
Fusible Metal
Coinage
Pinchbeck
Solder
Flux
Galvanized Iron
Steel Wool

The ornamental working of metals into small objects is also to be considered, and there are a number of articles which treat the subject from the artistic as well as the practical side. These titles include:

Jewelry
Plate, Sheffield
Tableware, Silver-Plated
Gold-Beating
Gold-Beater's Skin
Repousée
Enamel
Embossing

B. Construction

BUILDING AND BUILDING MATERIALS.

The materials used in building embrace natural and artificial substances which are specially wrought for the purpose. Whether we start with the lumber from the forest or the stone of the quarry, we find that there are a number of processes which have to be gone through before the material is finally disposed of in its appointed place. Considering first the materials for building, together with their sources, the following list has been constructed:

- Building-Stone
- Quarry, Quarrying
- Stone Cutting and Dressing
- Stone, Artificial
- Clay
- Brick
- Mortar
- Kiln
- Cement
- Concrete
- Terra Cotta
- Tile
- Gypsum
- Lumber Industry
- Factor of Safety
- Strength of Materials

For a study of the process of BUILDING, the article under that title will furnish an adequate idea. The separate branches, however, require more extensive treatment, as the following topics will suggest:

- Building
- Carpentry
- Cabinet Work
- Foundation

Masonry

- Brick Work
- Fireproof Construction
- Steel Skeleton Construction
- Half Timber
- Plaster, Lathing and Plastering
- Heating and Ventilation
- Plumbing
- Elevator
- Paper-Hangings
- Painting
- Illumination
- Gas, Illuminating and Fuel
- Electric Lighting

For certain forms of building, such as APARTMENT HOUSES and HOTELS, somewhat different equipment is required, and these are discussed under their own heads. For building operations in general, there are a number of minor topics that require a separate treatment. These may be included in the following list:

- Centring
- Chimney
- Door
- Window
- Framing
- Column
- Girder
- Beam
- Brace
- Roof
- Gutter
- Lightning, Protection from
- Lock
- Alarm
- Fire-Escape
- Calcimine
- Heating and Ventilation

C. Engineering

The constantly broadening field of engineering endeavor has resulted in dividing the work, so that to-day an engineer adopts but a comparatively small field for his own activity. Under **ENGINEER AND ENGINEERING** will be found a description of the modern divisions of engineering work and the qualifications of the men that follow each branch. In civil engineering, first may be mentioned the surveyor.

SURVEYOR.

Surveying involves the measurement of distances and areas and the delineation of the territory examined. It is carried on in different ways, depending on the extent and character of the country under survey. The following shows the general division of topics:

- Surveying
- Coast and Geodetic Survey
- Geological Survey
- Geodesy
- Triangulation
- Isostasy
- Deflection of the Plumb Line
- Hydrography
- Dredge
- Sound, Sounding
- Photographic Surveying
- Altimetry
- Hypsometry
- Leveling
- Offset
- Map
- Engineering Instruments
- Theodolite
- Plane-Table
- Stadia
- Telemeter
- Vernier

- Sextant
- Compass, Solar
- Planimeter
- Range-Finder
- Aneroid
- Heliograph
- Odometer

RAILWAYS.

After a general and comprehensive review of the subject of **RAILWAYS** in the article of that title, particular parts require somewhat fuller treatment, involving, as they do, engineering and other features of a unique character. For this purpose, the following list is supplied:

- Railways
- Street Railway
- Urban Railways
- Electric Railways
- Ship Railway
- Locomotive
- Compressed-Air Locomotive
- Tunnel
- Bridge
- Cantilever
- Viaduct
- Culvert
- Gauge
- Frog, Railway
- Fish Plate
- Block-Signal System
- Air Brake
- Buffer, Buffing Apparatus
- Bumping Posts
- Snow-Plow

RIVER AND HARBOR IMPROVEMENTS.

Various important works to aid maritime commerce consist in the erection of numerous harbor and river im-

provements. These are of a permanent character and require special engineering. Such works are described in the list below:

- Lighthouse
- Buoy
- Jetty
- Breakwater
- Embankments
- Cofferdam
- Foundation
- Dike
- Harbor
- Dredge
- Levee
- Dock
- Pile
- Excavating Machinery
- Blasting
- Caisson
- Masonry
- Retaining Walls
- Quay

CANALS.

When canals are carried across an isthmus, as at Suez or Panama, they may involve also many of the essential characteristics of harbor improvements; yet such works show considerable variation, and, when ordinary inland canals or those in connection with an irrigation system are considered, the methods of construction are quite different. The following list suggests a line of topics that could with profit be consulted:

- Canal
- Irrigation
- Panama Canal
- Nicaragua Canal
- Suez Canal
- Corinth Canal
- Erie Canal

- New York State Barge Canal
- Cape Cod Canal
- Saint Mary's Canal
- Welland Canal
- Chicago Drainage Canal
- Trans-Isthmian Canal
- Ship Railway

WATERWORKS AND HYDRAULIC ENGINEERING.

The use of water practically involves a separate department of engineering, but one in contact at many points with civil, sanitary, mechanical, and electrical engineering. It is necessary first to consider WATER SUPPLY, or the sources of water, then its storage, transmission, purification, distribution, and final consumption, and also various devices that are employed in these different stages. The material on this subject in the *New International Encyclopædia* is represented in the following list:

- Water Supply
- Hydrography
- Well-Sinking
- Artesian Wells
- Dams and Reservoirs
- Hydrostatics
- Hydrodynamics
- Current-Meter
- Weir
- Irrigation
- Pipe
- Water Purification
- Water-Works
- Fire Protection
- Pumps and Pumping Machinery
- Valve
- Water Power
- Filter and Filtration
- Accumulators
- Hydraulic Ram
- Water Wheel and Turbines

Hydraulic Press
 Archimedes' Screw
 Danaide
 Hydraulic Pressure Engine
 Water Meters
 Hydraulic Elevator (under Elevator)

SANITARY SCIENCE.

Under this somewhat comprehensive title, may be included such schemes as tend to improve and safeguard the health of mankind. See:

Hygiene
 Diet
 Occupational Diseases
 Schools, Medical Inspection of
 Health, Boards of
 Sanitary Commission
 Sanitary Laws
 Quarantine
 Water Supply
 Water-Works
 Water Purification
 Plumbing
 Garbage and Refuse Disposal
 Sewage Disposal
 Sewerage
 Disinfectants
 Drainage
 Catch-Drains
 Heating and Ventilation
 Bath-Houses, Municipal
 Slaughter Houses
 Burial
 Cemetery
 Cremation of the Dead
 Health Association, American Public

MUNICIPAL ENGINEERING.

The various applications of engineering knowledge to a large city result in the solving of many problems, such as water supply, transportation, the

provision of **PARKS and PLAYGROUNDS** for the masses, etc., and especially the fundamental ones involved in **CITY PLANNING**, which are now engrossing the attention of many American cities. These subjects, grouped from this point of view, will be found in the following list:

City Planning
 Road
 Street
 Boulevard
 Road and Street Machinery
 Asphalt
 Pavement
 Subways
 Electric Railways
 Street Railways
 Urban Transportation
 Water-Works
 Illumination
 Electric Lighting
 Parks and Playgrounds
 Landscape Gardening
 Recreation Piers
 Bath-Houses, Municipal
 Garbage and Refuse Disposal
 Municipal Ownership
 Public Utilities

See also preceding section on Sanitary Science.

FIRE PROTECTION.

The surest fire protection is **FIRE-PROOF CONSTRUCTION** for buildings, seen at its best in **STEEL SKELETON CONSTRUCTION**, where combustible material is reduced to a minimum. Then there are **SAFES and SAFE DEPOSIT VAULTS** for valuables, and the use of **INCOMBUSTIBLE FABRICS**. When these safeguards are unavailing, however, recourse must be had to the various apparatus for fighting fire, such as the

FIRE-ENGINE, now seen in its self-propelled form, the motor fire-engine, the high pressure pumping service, the **FIRE-EXTINGUISHER**, etc. See:

- Fireproof Construction
- Safes and Safe Deposit Vaults
- Fireproofing
- Incombustible Fabrics
- Fire-Alarm
- Fire Protection, Municipal
- Fire-Engine
- Fire-Extinguisher

MECHANICAL ENGINEERING.

For raising and transporting materials, and for carrying on other important operations, many interesting mechanical devices are constructed. The **CABLEWAY**, **TELPHERAGE**, **DERRICK**, and **TRAVELING SIDEWALK** are typical of the former class, while **GRINDING** AND **CRUSHING MACHINERY** and **AIR COMPRESSOR** may be cited as divisions of the many branches of mechanical engineering. A list of such subjects as are not already cited under other heads includes:

- Derrick
- Crane
- Cableway
- Telpherage
- Ropeway
- Traveling Sidewalk
- Elevator
- Air Compressor
- Blowing-Machines
- Pneumatic Dispatch
- Power, Transmission of
- Dynamometer
- Brake
- Prony Brake
- Air Brake
- Lubricants
- Wood-Working Machinery

MECHANICAL DEVICES.

In the construction of machinery there are certain elementary parts that enter into its design. These serve such purposes as changing the direction of a motion, increasing or reducing speed, or permitting its control in any desired way. See:

- Mechanical Powers
- Axle
- Shafting
- Wheel and Axle
- Lever
- Pulley
- Crank
- Cam
- Eccentric
- Winch
- Windlass
- Inclined Plane
- Wedge
- Toggle Joint
- Screw
- Endless Screw
- Belt
- Gear-Wheel
- Gearing
- Couple

PRIME MOVERS.

For the generation of power there are a number of sources to be considered. **HEAT**, **STEAM**, **ELECTRICITY**, **WATER POWER**, **WIND**, etc., are all treated in their proper places, but under this head may conveniently be included articles describing the means for transforming energy into mechanical power available for a thousand and one different purposes. See:

- Hot-Air Engine
- Compressed-Air Engine
- Compressed-Air Locomotive
- Gas-Engines

Internal-Combustive Engines

Motor Vehicle

Fireless Engine

Steam Engine

Steam Turbine

Water Wheel

Windmill

Hydraulic Ram

Hydraulic Press

Hydraulic-Pressure Engine

Dynamo-Electric Machinery

Mechanical Powers

STEAM AND STEAM ENGINE.

Commencing with a consideration of the properties of steam, any discussion soon reaches the **STEAM ENGINE** and its various parts and its applications. Such will be found in the classification given below:

Steam

Boiler

Economizers

Shaking Grates

Æolipile

Steam Engine

Locomotive

Steam Navigation

Steam Turbine

Pumps and Pumping Machinery

Eccentric

Crank

Fly-Wheel

Governor

Valve

Injector

Indicator

Safety Valve

Condenser

Horse-Power

ELECTRICAL ENGINEERING.

In Electrical Engineering, we may include the generation and distribution

of electric current, also its use for light and power, and the methods by which it is transmitted to considerable distance. The subject is treated in the following articles:

Dynamo-Electric Machinery

Armature

Cable, Electric

Transformer

Synchronizer

Transmission of Power

Electric Lighting

Electric Furnace

Electric Heater

Electric Railways

Urban Transportation

Electro-Chemistry

Storage Battery

Electrolysis

Welding

Lightning-Arresters

Electric Fuze (under Fuze)

For a discussion of the phenomena of the electric current, see the comprehensive section on Electricity in the chapter on Physics.

TOOLS.

Many and varied tools have been and are used by the mechanic, which are discussed in the articles dealing with the various industries. Certain groups and individual tools, however, demand consideration. Thus, **METAL** and **WOOD-WORKING MACHINERY** include many important tools, the chief types of which it is desirable to understand. **PNEUMATIC TOOLS** have resulted in considerable saving of labor and are of increasing importance. Many tools, such as the file, hammer, and axe, still survive and are not yet

replaced by machinery. The list in alphabetical order is as follows:

Axe
Boring Machinery
Calipers
Cutlery
Drill
File
Hammer
Jack
Mandril
Marlinespike
Metal-Working Machinery
Micrometer
Plane
Pneumatic Tools
Sand Blast
Sandpaper
Saw
Sawmill
Screw
Wood-Working Machinery

TELEGRAPH AND TELEPHONE.

The transmission of intelligence is constantly being accomplished more effectively and by a greater variety of methods, specialization having its play here as in other branches of applied electricity. The following articles may be recommended as supplying a complete idea of the history and development of these important processes:

Telegraph
Signaling and Telegraphing, Military
Lightning-Arresters
Telautograph
Telegraphy, Submarine
Atlantic Telegraph
Wireless Telegraphy
Telephony
Coherer
Telephone

Chapter 19. Efficiency and Industrial Management

WHILE few terms have been more abused in recent years than the word "Efficiency," which may be interpreted all the way from implying some occult science for making two blades of grass grow where one or even less previously flourished, to some simple means for securing greater output of a factory or business, it may be understood, however, in its strictly technical sense, as the ratio of the actual to the possible, or output to input. In such studies are involved much that can result and be interpreted to the advantage of mankind, so that in mathematical language a condition will be realized where this ratio will approach nearer to unity. For true efficiency there must be a knowledge both of the actual and the possible, expressed exactly and quantitatively, and then the employment of various means to eliminate waste and lost motion, so that the enterprise shall be more productive and yield greater returns, both gross and net. To accomplish this there are various methods, differing as to their manner and as to the claims advanced for their merits and workability, yet essentially the same if examined as regards their psychological and philosophical fundamentals.

Accordingly, when one investigates the subject of **SCIENTIFIC MANAGEMENT** he must first learn its objects and then appreciate wherein it is scientific, and then determine the various methods and schools of thought that have developed to secure these objects. Therefore, the student in this field should consult the fundamental articles on **EFFICIENCY** and **INDUSTRIAL MANAGEMENT**, but he will find also that in addition he will be required to inform himself as regards **BOOKKEEPING** and **ACCOUNTING**, for all studies in this field must depend upon records and bear a relation to the final system of accounts and values that show the profit of the enterprise. Accordingly, one might suggest the following list of titles that develop this interesting field of modern thought:

Efficiency
Industrial Management
Scientific Management
Legislative Management
Premium Plant
Motion Study
Time Study
Task and Bonus
Unit System

The articles **BOOKKEEPING** and **ACCOUNTING**, previously mentioned, should be read and also that on **RAILWAYS**, where, in the case of American railways, there has been much dispute as to the degree of efficiency that is secured in their operation, the principles of scientific management being designed to find application here if anywhere.

30. Military and Naval Science

AS the purpose of an army or any military organization is to carry on, or at least be prepared to carry on, war, either of defense or of offense, as effectively as possible, a study of the topic **WAR**, to ascertain under what circumstances recourse is had to the court of arms and under what conditions the laws and usages of nations demand that war shall be waged, makes a fitting beginning for reading in this field. Then, coming to the actual operations of war, we find that they must be planned according to the principles of **STRATEGY** and executed along lines worked out in systems of **TACTICS**. Accordingly, then, a suitable grouping of allied subjects is as follows:

A. Armies

War
Strategy
Tactics, Military
Military Aëronautics
Attack
Assault
Fire
Battle
Engagement
Skirmish
Invasion
Blockade
Fortifications, Attack and Defense of
Siege
Sap
Bombardment
Coast Defense
Manœuvres
Evolutions, Military
Demonstration
Marching
Manual of Arms
À Cheval Position
Ambuscade
Ambush
Debouching
Échelon
Enfilade
Feint

Point d'Appui
Retreat
Base of Operations
Advance Guard
• Cavalry Screen
Outposts
Picket
Patrol
Guard
Main Guard
Rear Guard
Flank
Reconnaissance
Prisoner
Contraband of War

ORGANIZATION.

To carry out, however, any scheme of strategy and tactics involves an army whose effectiveness depends upon its organization. In the organization of an army, the **INFANTRY**, **CAVALRY**, and **ARTILLERY**, or **LINE**, must be considered. These are its prime essentials, together with its **ENGINEERS**, **MEDICAL DEPARTMENT**, **COMMISSARIAT**, Department of the **QUARTERMASTER**, **SIGNAL CORPS**, Bureau of Military Justice, or Judge Advocate's Department, its Pay Corps, **GENERAL STAFF**, and the vari-

ous other bureaus and departments upon the efficiency of which the successful organization and operation of a military body depend.

Looking at military organization from the point of view of the units of which an army is made up, we may start with the CORPS, and gradually proceed from one command to an inferior one, learning the function of each and its relation to the common whole. RANK AND COMMAND is the keystone of military organization. Over each body of men there must be an appropriate officer, and to learn his duties it is but necessary to consult the article on this subject. In addition to officers, there may be certain subordinate individuals who have peculiar or individual functions to perform; these too are best described under their own heads. The accompanying lists suggest the relation of many of these topics. Dealing first with the division which may be headed Armies and Army Organization, we find large and adequate treatment, the historical side here as well as elsewhere in the Encyclopædia being considered. The first group deals with the divisions of military organization, the second, entitled RANK AND COMMAND, with the individuals of all ranks that form an army. See:

(a) *Armies and Army Organization:*

- Army Organization
- Armies
- Corps
- Division
- Brigade
- Regiment
- Battalion
- Squadron
- Company

(b) *Rank and Command:*

- Battery
- Platoon
- Detachment
- Artillery
- Artillery Corps
- Artillery Train
- Cavalry
- Infantry
- Mounted Infantry
- Engineer Corps
- Medical Department, United States Army
- Medical Department, United States Navy
- Ambulance
- Hospital Corps
- Signal Corps
- General Staff
- Staff
- Military Police
- Band, Military
- Pioneer
- Sharpshooter
- Color-Guard
- Reserve
- Cadre
- Contingent
- Column
- Militia
- Landwehr
- War, Department of
- Horse Guards
- Life Guards
- United States Army (under United States)
- Field-Marshal
- General
- Lieutenant-General
- Major-General
- Brigadier-General
- Colonel
- Lieutenant-Colonel

Major
 Captain
 Lieutenant
 Cadet, Military
 Cadet, Naval
 Adjutant-General
 Adjutant
 Aide-de-Camp
 Commissary
 Quartermaster
 Paymaster
 Surgeon, Military
 Inspector-General
 Chaplain
 Contract Surgeon
 Commander-in-Chief
 Commandant
 Field Officer
 Ensign
 Cornet
 Non-Commissioned Officer
 Color-Sergeant
 Drum Major
 Sergeant
 Corporal
 Gunner
 Artificer
 Drummer
 Orderly
 Private
 Bombardier
 Sentinel

MILITARY ENGINEERING.

To the military engineer are assigned many problems connected with the existence and operation of an army. He has to provide for its protection in both peace and war, which involves the construction of suitable barracks, camps, and fortifications, both temporary and permanent, and is besides required to study and delineate the country in which the troops live or operate.

Naturally, the chief division to be made in the topics relating to this subject is FORTIFICATION, involving the construction of more or less permanent works, and Field Engineering, dealing with those of a more temporary character. See:

Engineering, Military
 Fortification
 Military Architecture
 Battery
 Bastion
 Berm
 Blockhouse
 Caponiere
 Casemate
 Coast Defense
 Embrasure
 Epaulement
 Traverse
 Stockade
 Enceinte
 Frontier, Military
 Trench, Military
 Escarp
 Gallery
 Magazine
 Martello Tower
 Orillon
 Abatis
 Bill-Hook
 Blindage
 Barricade
 Cheveaux-de-Frise
 Fascines
 Gabion
 Approaches
 Parallels
 Siege and Siege Works
 Demolition
 Breach
 Camp
 Bridges and Docks, Military
 Mines and Mining, Military

Redoubt
Retrenchment
Revetment
Redan

FORTS OF THE UNITED STATES.

With a description of the principles of Fortification and Military Encampments, or posts, may properly be included a description of such military posts of the United States as are of importance for one reason or another. These are included in the following list, and the articles give information as to their location, garrison, general characteristics, etc.

Fort Adams
Fort Bliss
Fort Canby
Fort Caswell
Fort Clark
Fort D. A. Russell
Fort Douglas
Fort Du Pont
Fort Ethan Allen
Fort Flagler
Fort Grant
Fort Greble
Fort Hamilton
Fort Hancock
Fort Howard
Fort Jay
Fort Keogh
Fort Leavenworth
Fort Logan
Fort McHenry
Fort McPherson
Fort Meade
Fort Monroe
Fort Morgan
Fort Myer
Fort Porter
Fort Preble
Fort Riley

Fort Robinson
Fort Sam Houston
Fort Schuyler
Fort Sheridan
Fort Snelling
Fort Stevens
Fort Strong
Fort Terry
Fort Thomas
Fort Totten
Fort Trumbull
Fort Wadsworth
Fort Warren
Fort Washington
Fort Wayne
Fort William H. Seward
Fort Yellowstone
Columbus Barracks
Jefferson Barracks
Madison Barracks
Plattsburg Barracks
San Diego Barracks
Vancouver Barracks
Washington Barracks

ORDNANCE AND GUNNERY.

To carry on warfare, many weapons and resources have been placed at the disposal of the soldier. Such titles as ARTILLERY, ORDNANCE, EXPLOSIVES, AËROPLANES, SUBMARINES, GUNPOWDER, PROJECTILES, SMALL ARMS, naturally suggest themselves as principal topics. With them may be grouped the underlying science as embodied in BALLISTICS and GUNNERY, together with the other topics contained in the following list:

(a) *Artillery:*

Coast Artillery
Field Artillery
Horse Artillery
Mountain Artillery

Siege Gun
Guns, Naval
Rapid-fire Guns
Machine Gun
Mitrailleuse
Gardner Gun
Mortar
Howitzer
Air Gun
Pneumatic Gun
Submarine Gun
Ordnance
Ordnance Establishments
Cannon
Jacket
Bore
Calibre
Artillery Carriages
Gun-Carriage
Limber
Caisson
Small Arms
Carbine
Chassepôt
Arquebus
Bayonet
Pistol
Revolver
Target and Target Practice
Sword

(b) *Projectiles:*

Ammunition
Grape-Shot
Case-Shot
Canister
Carcass
Grenade
Bomb
Shrapnel
Rocket
Cartridge
Torpedo

(c) *Explosives:*

Gunpowder
Smokeless Powder
Dynamite
Nitroglycerin
Atlas Powder
Cordite
Lyddite
Maximite
Picric Acid
Dualine
Fulminates
Fulminate of Mercury
Fulminate of Silver
Pyrotechny
Primer
Fuze
Greek Fire
Charge
Matches

(d) *Gunnery:*

Ballistics
Range
Range-Finder
Aim
Charge
Plongée
Ricochet
Target and Target Practice
Target Practice, Naval
Proving Ground
Loading-Tray

(e) *Historic Cannon:*

Coehoorn
Columbiad
Demi-Cannon
Demi-Culverin
Falcon
Jingal
Mitrailleuse

UNIFORM AND EQUIPMENT.

Closely connected with the soldier's

and sailor's weapons are his Uniform and Equipment, the various insignia often being matters of considerable interest and curiosity to the layman. With these subjects, we may include allied topics as follows:

- Military Insignia
- Uniforms, Military and Naval
- Aiguillettes
- Bandolier
- Busby
- Canteen
- Cartouch
- Chevrons
- Epaulet
- Facings
- Good Conduct Badges
- Haversack
- Helmet
- Képi
- Khaki
- Kit
- Knapsack
- Spur
- Sword

MILITARY CEREMONIES.

As a witness of various military ceremonies or other formalities, the layman comes in contact with certain other aspects of army and navy life. The more important of these will be treated under their respective heads. See the following:

- Salutes
- Feu-de-Joie
- Dress Ship
- Escort
- Review
- Inspection
- Parade
- Muster

FLAGS.

Flags of one kind or another, by rea-

son of their histories and tradition and their special uses at the present time, play an important part in military and naval affairs. Besides being the emblem of the nation, they may also pertain to various organizations or individuals, as the colors of a regiment or the flag of an admiral. These will be understood on reference to the following articles, many of which are illustrated by colored plates:

- Flag
- Ensign
- Colors
- Guidon
- Standard
- Pennant
- Jack
- Union Jack
- Flag of Truce
- Signaling and Telegraphing

HISTORIC AND SPECIAL MILITARY ORGANIZATIONS.

Military organizations in the past, as well as in the present, have been formed either for special purposes or under special auspices, or as independent commands. Some of the more famous classes of soldiers and historic military organizations are those included in the following list:

- Artillery Company, Ancient and Honorable
- Artillery Company, Honorable
- Bashi-Bazouks
- Beefeater
- Bersaglieri
- Black Watch
- Cameronians
- Carbineers
- Chasseurs
- Cohort
- Coldstream Guards

Colonial Corps
Cossacks
Cuirassier
Dragoons (under Cavalry)
Equestrian Order
Fencible
Foot Guards
Francs-Tireurs
Fusiliers
Green Mountain Boys
Grenadier
Grenadier Guards
Guard
Guerrillas
Guide
Gurkhas
Highlanders
Honvéd
Horse Guards
Household Troops
Hussars
Janizaries
Lancer
Landsturm
Landwehr
Legion
Life Guards
Mamelukes
Minute Men
Mobiles, Corps of
National Guard
Phalanx
Rangers, Mounted
Rifleman
Rough Riders Association
Scots Greys
Sepoy
Sikhs
Spahis
Streletsi
Trainbands
Voltigeurs
Yeomanry
Yeomen of the Guard

Zouaves

MILITARY LAW.

For the government of the army there are certain statutes and regulations. International law in many of its aspects touches on the acts of armies in the field. Accordingly, a grouping of certain topics allied, though not necessarily logically connected, may be made as follows:

Military Law
Acts of Hostility
Allegiance
Armistice
Articles of War
Belligerent
Blockade
Booty
Bounty
Capitulation
Cartel
Cashiering
Casus Belli
Conscription
Contraband of War
Council of War
Courts Military
Declaration of War
Desertion
Discharge
Judge-Advocate
Judge-Advocate-General
King's Regulations
Martial Law
Military Commissions
Military Government
Military Law
Military Police
Military Prison
Neutrality
Posse Comitatus
Prisoner
Privateering

Prize
Prize Courts
Provost-Marshal
Ransom
Spy
Truce
War

MILITARY AND NAVAL EDUCATION.

The professions of the soldier and sailor require from beginning to end continual training, and from Academy to War College there are many studies to be pursued. Grouping those topics referring to the education of the soldier and sailor, we have the following list:

Army Schools
Artillery Schools
Cadet, Military, Naval
Military Geography
Cavalry and Light Artillery School
Military Education
Military Academy, U. S.
General Service and Staff College
Staff Colleges and Schools
War College
Naval Academy, U. S.
Naval Schools of Instruction
Naval Institute, U. S.
Discipline
Drill
Drill Regulations

MISCELLANEOUS.

The food for the soldier and his animals is discussed under RATIONS and FORAGE, and its mode of preparation

under FIELD COOKING. The principal BUGLE AND TRUMPET CALLS that summon him to his duties are given with the music notes, and the DRUM and FIFE, which supply the field music, are also treated. Methods of RECRUITMENT in various countries, and also RETIREMENT, should be studied, while the PAY AND ALLOWANCES of the soldier must be considered in order to understand army conditions at home and abroad. An essential of modern military operations is the maintenance of communication between every part of an army and its base, or capital. This is the function of the SIGNAL CORPS, whose operations and apparatus are treated under SIGNALING AND TELEGRAPHING, MILITARY. In the event of casualties, the SURGEON and the MEDICAL DEPARTMENT, with its HOSPITAL CORPS, are called into requisition, protected as they are by the terms of the GENEVA CONVENTION. It is advantageous to learn the present conditions of SURGERY, MILITARY, and the peculiar problems that the military surgeon has to face, as well as his methods of operation. In this connection, also, should be mentioned the work of the RED CROSS, and the part it plays in alleviating suffering on the battle-field. Of importance, as in a small way reproducing some of the conditions of warfare, the WAR GAME is worthy of consideration, as on its board may be worked out many interesting problems in strategy and tactics.

B. Ships and Navies

No clearer distinction can be drawn in discussing vessels for navigating the seas than to consider separately those

for military purposes and those for commerce, but it is not always possible to make the separation complete,

and many subjects concerning nautical affairs cover or apply to both classes. Under NAVIES and SHIP AND SHIPPING (subhead *Ship, Armored*) are given historical accounts of the development of war craft, while the evolution of the merchant ship is traced under NAVIGATION, SHIPBUILDING, and SHIP AND SHIPPING (subhead *Power Navigation*). In the following lists the different kinds of warships, merchantmen, and boats which are separately described under their own titles are collected under the proper head:

(a) *Warships:*

Warship
 Ship, Armored (subhead under Ship and Shipping)
 Battleship
 Cruiser
 Fuel Ship
 Gunboat
 Torpedo Boat
 Torpedo Boat, Submarine
 Hospital Ship
 Ram
 Guard-Ship
 Receiving Ship
 Galley
 Galliot
 Trireme
 Fire-Ship
 Floating Battery
 Frigate
 Monitor
 Mortar Vessel
 Corvette

(b) *Merchantmen:*

Ship and Shipping and its various subheads
 Power Navigation (subhead under Ship and Shipping)
 Clipper

Bark
 Brig
 Schooner
 Sloop
 General Ship
 Composite Ships
 Lighter
 Whaleback
 Yacht
 Lugger
 Junk
 Grab
 Dhow
 Corsair
 Ketch
 Pinnace
 Pirogue
 Pram
 Great Eastern
 Launch, Launching
 Derelict
 Wreck

(c) *Boats:*

Lifeboat
 Life-Rafts
 Balsa
 Launch
 Whaleboat
 Long Boat
 Jolly-Boat
 Punt
 Cutter
 Catboat
 Canoe
 Catamaran
 Banca
 Ice-Breaking Steamer
 Barca
 Kayak
 Ferry

NAVIES, NAVAL AFFAIRS, ETC.

There is included under this head, in the following lists, articles pertain-

ing not only to the navy proper, but to such government services as are connected with naval and nautical affairs, such as Coast Guard, Life-Saving Service, etc.:

(a) Organization and General Subjects:

Navies
Tactics, Naval
Marine Corps
Engineer, Naval
Medical Department, United States Navy
Hydrographic Office
Navy, Department of the
Naval Academy
Naval Schools of Instruction
Naval College of Canada
Revenue Cutter Service, United States
Life-Saving Service
Coast Guard
Naval Reserve
Crew
Company, Ship's
Complement
Watch
Division
Landing Force
Billet
Mess
Pay and Allowances
Naval Reserve

(b) Officers and Men:

Admiral
Commodore
Captain
Commander
Lieutenant-Commander
Lieutenant
Ensign
Midshipman
Clerk, Paymaster's

Commanding Officer
Commandant
Flag-Officer
Executive Officer, United States Navy
Surgeon, Military and Naval
Paymaster
Watch Officer
Naval Constructors
Chaplain
Provost-Marshal
Pilot
Warrant Officer
Gunner
Master
Master-at-Arms
Mate
Carpenter, Navy
Boatswain
Machinist, Naval
Petty Officer
Quartermaster
Coxswain
Naval Apprentice
Landsman
Boys, Ships'

(c) Naval Ordnance, Gunnery, Torpedoes, etc.:

Guns, Naval
Gunpowder
Smokeless Powder
Guncotton
Rapid-fire Guns
Machine Guns
Target Practice
Target
Torpedo
Torpedo Director
Torpedo Net
Rangefinder
Stadimeter
Projectile
Mine, Submarine

(d) *Merchant Marine and Allied Subjects:*

Navigation
 Merchant Marine (of U. S.)
 Ship and Shipping, subheads of:
 Sailing Ship
 Power Navigation
 Classification of Ships for
 Marine Insurance
 Tables showing tonnage of
 ships built and building in
 the merchant navies of the
 world
 Great Eastern
 Load-line Marks of Vessels
 Measurement of Ships for Ton-
 nage
 Safety at Sea
 Rules of the Road at Sea
 Fog Signals
 Coasting Trade
 Trade, Board of
 Trinity House
 Crew
 Master
 Mate
 Pilot

See also the titles grouped under Maritime Law and Navigation on subsequent pages.

SHIPBUILDING AND NAVAL ARCHITECTURE.

The enormous size and great speed of many modern vessels require study, experience, and scientific attainments of the highest class for their design and construction. Under the head of SHIPBUILDING will be found a historical sketch of the subject, a description of the theory of design, of the means and methods of hull construction, and of the design, development, and construction of propelling and

other machinery. The principal titles under which shipbuilding information is to be found are:

Armor Plate
 Ship and Shipping, and subheads
 Shipbuilding, and subheads
 Launch, Launching
 Navigation
 Load-line Marks of Vessels
 Marine Engineering
 Steam Engine
 Steam Turbine--
 Boiler
 Buoyancy
 Stability
 Metacentre
 Resistance
 Displacement
 Tonnage
 Measurement of Ships for Tonnage
 Lloyds
 A 1

The various parts of a vessel are almost infinite in number. The articles SHIPBUILDING and SHIP will tell of these various parts and describe how the skill of naval architect, marine engineer, and shipbuilder unites them into one congruous whole. Such parts, however, often possess distinct features and characteristics which need separate treatment, and these are included in the following list:

Beak
 Bilge
 Beam
 Bottom
 Bow
 Bridge
 Bulkhead
 Bulwark
 Cockpit
 Cofferdam
 Companion

Deck
Figurehead
Gangway
Hawse
Helm
Hold
Keel
Keelson
Paddle-Wheel
Poop
Screw Propeller
Smokepipe

To gain a good idea of the rigging of a ship and the names of masts, sails, etc., the best plan is to consult the plate accompanying the article **SHIP**, where all the various parts of the rigging of a full-rigged ship are indicated and specified. There are various topics connected with sails and rigging that are described and their functions shown in brief articles. Such a list includes the following:

Belay
Block
Boom
Bowsprit
Brace
Brail
Bridle
Burton
Clip Hooks
Cordage
Crow's-Nest
Davit
Gaff
Halliards
Jib
Jury
Knotting and Splicing
Lateen Sail
Lug-Sail
Mast

Purchase
Rigging
Sail
Spanker
Spinnaker
Sprit
Stay
Tackle

Connected with the ship, but not wholly falling in any of the above classes, are many essentials such as the **ANCHOR**, the **BINNACLE**, the **DAVIT**, etc. These adjuncts are specially designed for specific purposes, which the reader naturally desires to understand. The following list includes some of the more important subjects in such a grouping:

Anchor
Ballast
Batten
Bells
Binnacle
Block
Boiler
Boiler (under Shipbuilding)
Bridle
Buoy
Burton
Cable
Canvas
Capstan
Cat
Cofferdam
Compass
Controller
Cordage
Davit
Fender
Ground-Tackle
Mooring Swivel
Kedge
Knotting and Splicing

Lifeboat
Life Buoy
Life-Preservers
Life-Rafts
Life-Saving Guns and Rockets
Life-Saving Service
Lights
Marling Spike
Oakum
Purchase
Rope
Smokepipe
Stopper
Tackle
Wheel
Winch
Windlass

Safety at Sea
Rhumb Line
Meridian
Map
Loxodrome
Chart
Hydrography
Meteorology, Marine
Sound, Sounding
Coast Pilot
Bowditch's Practical Navigator
Almanac
Nautical Almanac
Ephemeris
Pilot Chart
Protractor
Sextant
Quadrant
Vernier

NAVIGATION.

Navigation involves the conducting of a vessel from one port to another by making use of charts, the position of various heavenly bodies as determined by the navigator, and such other data as he can obtain by observation and calculation. In general this is contained in the article NAVIGATION, but further details and explanations are given of incidental topics. The following list will be found by the reader sufficiently comprehensive:

Navigation
Latitude and Longitude
Sailings
Binnacle
Compass
Log
Reckoning
Dead Reckoning
Day's Work
Departure
Deviation
Fog Signals
Rules of the Road at Sea

SEAMANSHIP.

Seamanship may be distinguished from navigation as dealing with the actual practice, rather than the theory, involving the handling of vessels and the means taken to insure their safety. Thus, under this head, is discussed such important subjects as the RULES OF THE ROAD, the use of the LOG, TACKING, jibing, mooring, and the various manœuvres and operations carried on at sea and in port. These hardly fall in a logical order, but the more important are contained in the following list:

Tacking and Wearing
Jibe
Boxhauling
Lee
Leeway
Moor, Mooring
Log
Log-Book
Helm

Steering
Port
Larboard
Starboard
Bearing
Sound, Sounding

MARITIME LAW.

Vessels sailing on the high seas are governed by rules and usages which have given rise to a body of laws known as admiralty and maritime law. Furthermore, such vessels are required to observe the statutes of the countries whose flags they fly, and such formalities as are duly prescribed. Connected with such governmental regulations are those of marine underwriters and insurance principles, forming a large department of maritime law. Interests at sea are also considered by international law, and prizes and privateering are subjects which it must consider. A grouping of interesting topics in these more or less related branches is as follows:

International Law
Admiralty Law
Maritime Law
Navigation Laws
Navigation, Freedom of
Ship's Papers
Manifest
Bill of Lading
Clearance
Bill of Health
Charter-Party
Cargo
Freight
Demurrage
Admiralty, The

Bounty
Collisions of Vessels
Bottomry Bond
Respondentia
Salvage
Derelict
Wharfage
Jettison
Barratry
Quarantine
Marine Insurance
Lloyds
A 1
Measurement of Ships for Tonnage
Tonnage
Load-line Marks of Vessels
Privateering
Prize
Prize Courts
Desertion
Safety at Sea

As the sailor must make his base of operations on shore, it is proper to consider such subjects as NAVY YARDS, DOCKS, etc., where he may secure supplies and protection. The following list indicates certain articles that will be of assistance in this respect:

Navy Yard
Dockyards, Royal
Arsenal
Reef
Harbor
Breakwater
Dock
Wharf
Torpedo Station
Naval Academy

Chapter 31. The Great War

THE WAR IN EUROPE is treated in an article that covers approximately the first two years of the war, and is a complete history of it in all its phases. It is divided into the following subdivisions: I, Underlying Causes; II, Outbreak of the War; III, Military Operations; IV, Naval Operations; V, Aërial Operations; VI, Alleged Atrocities in the War; VII, Destruction of Art and Architecture; VIII, Neutral Nations; IX, Relief Measures; X, Financial and Economic Aspects; XI, Bibliography. It is the purpose of this chapter to supplement the cross-references in the article itself, with a complete list of articles in the *NEW INTERNATIONAL ENCYCLOPEDIA*, which deal directly or indirectly with the war.

On June 28, 1914, Archduke Francis Ferdinand, the Austrian heir apparent, was assassinated with his wife at Sarajevo, the capital of Bosnia. This was the match that touched off the conflagration which had been brewing in Europe for years. Austria-Hungary, accusing Serbia of complicity in the affair and declaring that it was the Serb aim to secure the provinces of Bosnia and Herzegovina, sent an ultimatum to Serbia on July 23. Serbia's reply, delivered just before the expiration of the time limit, only partially complied with Austria-Hungary's demands. Despite the most strenuous efforts on the part of the larger countries of Europe, Austria-Hungary declared war on Serbia on July 28. Russia, the champion of the Slav Balkan States, issued an order of mobilization and, upon the refusal to withdraw this order, Germany declared war on her. This turned all Europe into an armed camp. France and England came to the aid of Russia, and Germany stood by her ally, Austria-Hungary. Italy, claiming that her Alliance with Germany and Austria-Hungary was purely defensive and claiming further that Austria-Hungary's declaration of war on Serbia was offensive, refused to join her partners in the Triple Alliance. With the entrance of Rumania into the war in August, 1916, we find the following alignment of powers: Russia, France, England, Italy, Belgium, Japan, Serbia, Montenegro, Portugal, San Marino and Rumania opposed to Germany, Austria-Hungary, Bulgaria and Turkey.

I. Underlying Causes

The Underlying Causes of the Great War fall naturally under three heads, namely: (1) National Antagonisms, (2) Militarism, and (3) Economic Rivalry.

1. NATIONAL ANTAGONISM.

The problem of national antagonism was an outgrowth of the Congress of Vienna, which concluded the French Revolution and Napoleonic periods. At this Congress many of the diplomats hoped that the principles of the French Revolution would be recognized and that the ruling ideas would be the recognition of the growth of democracy and the realization of national liberty. Because of the opposition of the reactionaries, particularly Metternich, these

ideas were subjugated and the attempt was made to restore the *ancient régime*. Thus we find the problem of nationality cropping up continually in the nineteenth century. Two examples of this will suffice to show the truth of this statement. As a result of the FRANCO-GERMAN WAR, Germany annexed Alsace and Lorraine, French-speaking territories. At the CONGRESS OF BERLIN, Russia's hopes of making the Balkan peninsula a Slav sphere of influence were frustrated by the jealousy of the other European powers. The French consequently hoped for the day of restoration and the national awaking of Russia foreshadowed her expansion to the Mediterranean. It might be mentioned, in passing, that if the principle of nationality was to be loyally carried out, the heterogeneous Austro-Hungarian Empire would be completely divided up among its neighbors, Transylvania to Rumania, Austria, proper, to Germany, etc.

Consult the following list of articles for a history of the growth of national antagonisms since the beginning of the nineteenth century:

French Revolution	Cavour
Napoleon I	Mazzini
Peninsula War	Garibaldi
Tugenbund	Eastern Question
Vienna, Congress of	Russo-Turkish War
Alexander I (Russia)	Berlin, Congress of
Charles XIV John (Sweden)	Pan Slavism
Stewart, Robert (Second Marquis of Londonderry, Castlereagh)	Pan-Germanism (under War in Europe)
Wellington, A. W.	Africa
Hardenberg, K. A.	Turco-Italian War
Humboldt, K. W.	Balkan War
Metternich, C. W. N. L.	
Nesselrode, K. R.	
Stein, H. F. K.	
Talleyrand-Perigord, C. M.	
Crimean War	
Declaration of Paris	
Paris, Treaties of	
Seven Weeks' War	
Schleswig-Holstein	
Bismarck-Schönhausen, K. O. E. L.	
William I (Germany)	
William II (Germany)	
Franco-German War	
Alsace	
Lorraine	
Benedetti, Vincent	
Napoleon III	

In order to learn the part played by individual countries during the nineteenth and early twentieth centuries, as well as to find such important historical material bearing on national antagonisms as the unification of Italy (under ITALY), the Graeco-Turkish War of 1897 (under GREECE), etc. See the historical sections of the following:

Albania
Austria-Hungary
Belgium
Bosnia
Bulgaria
Denmark

France
 Germany
 Greece
 Herzegovina
 Italy
 Montenegro
 Netherlands
 Norway
 Poland
 Portugal
 Rumania
 Russia
 Sardinia
 Servia
 Sicilies, Kingdom of the Two
 Spain
 Switzerland
 Turkey
 United Kingdom of Great Britain
 and Ireland

For the biographies of statesmen, soldiers, etc., prominent during the war see the treatment of the countries involved in Chapter I of this volume. Supplementary to the lists given there are the additional biographical footnotes at the bottom of the pages of the War in Europe article.

2. MILITARISM.

Militarism, as defined in the *NEW INTERNATIONAL ENCYCLOPEDIA*, is "A term employed somewhat loosely to designate a tendency to subordinate civil to military considerations in the policy of the State." We find that all the powers of Europe illustrate this tendency to a greater or less degree. Each has watched any move by the other and attempted to meet any increase in armament by a similar increase. For example, when Germany increased her army in 1913, France passed a law changing the term of ser-

vice to 3 years, because her slowly increasing population would not permit an outright increase. To appreciate the modern tendency, consult the sections on *ARMIES* and *NAVIES* in the articles on the more important countries mentioned above and the following general subjects, which contain also many appropriate cross references:

Militarism
 Armies
 Navies
 Military Education
 Imperialism
 Industrialism
 Peace Movement, International

3. ECONOMIC RIVALRY.

For the economic causes of the war it is not necessary to go back further than the beginning of the nineteenth century. Then occurred the Industrial Revolution, which substituted the factory system of manufacture for the cottage system. It also introduced the problem of capital and labor. With the vast increase in production, it was only natural that European countries should look for a market for their goods commensurate with the output. England had a monopoly of manufactures for almost three quarters of a century. Then France, Germany, etc., felt the effects of the revolution and began to look for their "places in the sun." The chief form taken by this economic rivalry was colonization and preferential tariffs. Africa and Asia were partitioned, practically between France and England, thus leaving Germany with no desirable place of expansion. Germany maintained that the adoption of preferential tariffs by the British colonies were attempts to crip-

ple German trade. For history of colonization and the tariff systems see history of countries mentioned *supra* and the following articles:

Political Economy
Industrial Revolution
Factories and the Factory System
International Trade
Commerce
Custom's Duties
Free Trade
Protection
Tariff
Mercantilism
Reciprocity
Taxation
Imperialism
Imperial Federation
Industrialism
Colony
Canada
Australia
India
New Zealand

Africa
Union of South Africa
Egypt
Morocco
Tripoli
German East Africa
German Southwest Africa
Kamerun
Togoland
Algeria
Angola
French West Africa
Upper Senegal and Niger
Asia
Persia
Afghanistan
Beluchistan
China
Manchuria
Korea
Eastern Question
Far Eastern Question
Open Door

II. Military Operations

The military operations in the WAR IN EUROPE are treated under the following main divisions:

I. Introduction and Discussion of Mobilization.

II. Western Theatre, or Campaign against France.

III. Eastern Theatre, or Campaign against Russia.

IV. Southern Theatre or Serbian and Italian Campaigns.

V. Southeastern Theatre or Turkish Campaigns.

For technical subjects, see the chap-

ter on MILITARY AND NAVAL SCIENCE and the following special articles:

Armies (also section under each country)
Mobilization
Army Organization
Artillery
Cavalry
Infantry
Frontier, Military
Militia
Military Education
Military Geography
Tactics, Military
Ammunition
Ballistics

Engineering, Military
Ordnance
Fortification
Battle

Articles which have had special treatment because of the war include the following:

(a) *Western Front:*

Ghent
Havre
Huy
Kiel
Knocke
La Bassée
La Fère
Lens
Liège
Lierre
Lille
Longwy
Lorraine
Louvain
Luxemburg
Lys
Maubeuge
Meaux
Mechlin
Menin
Metz
Meurth-et-Moselle
Meuse
Mézières
Mons
Montmedy
Moselle
Namur
Nancy
Nieuport
Nish
Novogeorgievsk
Ostend
Paris
Peronne

Piotrokov
Plock
Pont-A-Mousson
Poperinghe
Posen
Rheims
Roubaix
Roulers
Roye
Saarburg
Saint Dié
Saint-Quentin
Soissons
Souchez
Tirlemont
Toule
Tourcoing
Valenciennes
Verdun
Verviers
Ypres

(b) *Eastern Front:*

Galicja
Graudenz
Ivangorod
Jaroslau
Kalish
Kielce
Kolmar
Kolo
Königsberg
Krasnick
Lask
Lemberg
Lodz
Lomza
Lowicz
Lublin
Lyck
Marienburg
Marmaros-Szigét
Masurenland
Mlawa
Ostrolenka

Pinsk
 Poland
 Przasnysz
 Przemyśl
 Rzeszów
 Saint Petersburg
 Sambor
 Shavli
 Siedlce
 Silesia
 Stanislaw
 Stryj
 Suczawa
 Suvalky
 Tannenburg
 Tarnopol
 Tarnow
 Thorn
 Tilsit
 Tomaszow
 Transylvania
 Vilna
 Warsaw
 Wieliczka

(c) *Southern Front:*

Mostar
 Pirot
 Pola

Pozarévatz
 Prisrend
 Roveredo
 Saloniki
 Scutari
 Semendria
 Senlis
 Sarajevo
 Shabatz
 Tyrol
 Udine
 Uskop

(d) *Southeastern Front:*

Kars
 Khopa
 Suez Canal
 Tabriz
 Transcaucasia
 Urumia
 Van

(e) *Colonies:*

German East Africa
 German Southwest Africa
 Kiaochow
 Tahiti
 Union of South Africa
 Windhoek

III. Naval Operations

The naval operations during the Great War took place on almost every known sea. Engagements between fleets were comparatively scarce, until the great battle off Jutland. This engagement, with those off the coast of Chile and near the Falkland Islands, were the most important fleet activities. Outstanding features of the naval operations were the submarine warfare, the spectacular raids on merchantmen, the blockade of Germany and

the transportation of large numbers of troops from one place to another by the Allies. This section of the article is divided into the following divisions:

Operations in the North Sea and the Waters about Great Britain

Operations in the Baltic

Operations in the Mediterranean

Operations in the Black Sea and Dardenelles

Cruiser Operations in the Atlantic, Pacific and Indian Oceans

Naval Strategy of the War Some Naval Lessons of the War

For a complete list of the more important articles in the *NEW INTERNATIONAL ENCYCLOPÆDIA* dealing with naval science, see Chapter 30 in this volume. Some of this might well be mentioned here, together with titles brought into prominence by the war. See also section on *Navies* of the countries involved:

Navies
Armor Plate
Battleship
Ship, Armored
Torpedo Boat
Signals, Marine
Tactics, Naval
Target Practice, Naval
Naval Aëronautics
Naval Reserve
Naval Schools of Instruction

Naval Stores
Hartlepool
Helgoland
Kaiserwilhelmsland
Keeling Islands
Kiaochow
Kiel
Libau
Lissa
Marshall Islands
Memel
New Guinea
Odessa
Ragusa
Reval
Samoan Islands
Scarborough
Sebastopol
Solomon Islands
Togoland
Trebizond
Varna
Yarmouth

IV. Aerial Operations

For the first time in history, aerial operations played an important rôle in warfare. The aerial section of the Great War articles tells the different use to which the different types of aircraft were put. Consult Chapter 17 in this volume dealing with *AËRONAUTICS*. See:

Aëronautics
Navigation, Aërial, Law of
Military Aëronautics

Naval Aëronautics
Hangar
London
Luneville
Paris
Saarbrücken
Sandringham
Treves
Trieste
Venice
Verona

V. Neutral Nations

As the war developed it became almost as difficult for a neutral to maintain an attitude of strict neutrality as it was to be a belligerent. The trade

markets of the world were completely upset and all routes and methods of transportation changed entirely. Commerce carrying vessels of the bel-

ligerents were requisitioned for war purposes, and in many neutral countries also political, as well as economical, disturbances resulted. The destruction of neutral vessels, the seizure of neutral mails, etc., brought forth protests from many neutral nations. Besides the historical sections of the neutral nations, such as the United

States, Norway, Sweden, the Netherlands, see:

International Law
Neutrality
Armed Neutrality
Blockade
Contraband of War
Declaration of Paris
London, Declaration of

VI. Financial and Economic Aspects

The problem of financing the Great War proved to be extremely difficult. With trade and industry all but at a standstill, the usual channels for borrowing money were closed. War taxes of all descriptions were levied and old taxes were greatly increased. Large loans were sought at home and abroad. A large joint loan floated in the United States by the Entente Allies was followed by various national loans secured by undoubted collateral, as well as by the resources of the respective governments. The following list includes the more important ar-

ticles which deal with financing a war:

Tax
Moratorium
Credit
Rediscounting
Stock Exchange
Bonds
Stocks
Panic, Financial
Crisis, Economic
Money
Marine Insurance
Bank, Banking
Foreign Money

Chapter 32. Medicine

THE dissemination of some medical knowledge among the laity is a matter of inestimable social importance. Popular ignorance on the subjects of hygiene, the prevention of disease, and the care of the sick, places many widespread evils sadly beyond the power of the medical profession. The average man's failure, moreover, to appreciate clearly the soundness of the principles and methods of medical science invites the appearance in the community of various mystical, or mystifying, quacks, claiming to know therapeutic methods of all but miraculous efficiency, and offering to sell medicines which, like the philosopher's stone once vainly sought by the alchemists, possess unlimited curative powers. Honest and valuable knowledge to-day has no secrets, and, notwithstanding, or rather because of, really considerable development, is professedly aware of its limitations. Perhaps, therefore, the clearest mark of the impostor or incompetent is the alleged possession of secrets or of methods of universal applicability. Nor will the cunning theories, widely advertised in support of such allegations, appear at all reasonable to the man who has familiarized himself with the main principles and facts of scientific—that is, rational—medicine.

The lists of articles presented in the following pages map out a complete course of systematic reading in medicine. A true understanding of the purely medical subjects, even in their elementary aspects, is possible only after the acquisition of some knowledge of the general biological sciences and of chemistry. Thus, human anatomy is best understood if studied in connection with comparative anatomy. Physiology is more or less obscure if studied without a preliminary knowledge of the general principles of chemistry and biology, and, again, human physiology should be studied in connection with the physiology of the lower animals. Even general botany presents a number of points of the highest interest to the student of human anatomy and physiology. Should the assiduous reader of the *Encyclopædia* desire to familiarize himself with these and cognate subjects, the present volume will readily afford the necessary guidance. We would especially call attention to the psychological articles on the special senses and faculties, without which the physiological functions of the brain and nervous system cannot be thoroughly understood. Further, a large number of chemico-physiological articles on special foods, and of articles on subjects of veterinary medicine, will be found listed in the chapter Agriculture, Horticulture, and Forestry, those articles having been prepared for the *Encyclopædia* by the food and veterinary experts of the United States Department of Agriculture.

The classification of the medical subjects proper, on which the lists below are based, and the order of sequence of the subjects in the lists themselves, are those adopted by the best medical authorities, with slight modifications to suit the distribution of subject-matter in the *Encyclopædia*. The only considerable deviations from general usage are in the case of anatomy and physiology, the two being somewhat closely interwoven in the *Encyclopædia* and therefore, here, too, arranged as one joint subject. The listed articles comprise a complete

treatment of essentials. The reader desiring more detailed information on particular bones, muscles, nerves, etc., will be guided to the special articles on such subjects by cross-references in the articles listed.

The only lists in which the order of sequence of the topics is not according to some recognized system are those under "Symptoms and Morbid Conditions" (division, Pathology and Therapeutics) and "Diseases of the Skin" (division, Diseases of the Nose and Throat, Ear, Eye, Skin, and the Genito-Urinary System). The former list comprises those symptoms and morbid conditions that are common to more than one class of diseases and that could not, therefore, be included in the somewhat rigidly classified lists preceding. On the other hand, the orders of sequence of skin diseases usually adopted in special medical works are practically useless. It was, therefore, deemed best in both cases to preserve the alphabetical order—for convenience of reference. The list of "Drugs" (division, Materia Medica) includes all the pharmacopœial preparations in frequent use. A number of rarer drugs may be found described in the articles on chemical subjects.

The biographies of famous medical men are arranged in the order of historical sequence and, together with the articles listed under "History," form a complete presentation of the history of medicine—a truly fascinating subject. Interesting historical detail will also be found in the articles on all medical topics of any importance. The inclusion of such historical articles as BATH, BARBER, EMPIRIC, DERIVATION, BLACK DEATH, PLAGUE, INOCULATION, etc., would have swelled the lists unnecessarily.

1. INTRODUCTORY ARTICLES.

Medical Education
Homœopathy
Eclectic School of Medicine
Nurses, Training of
Clinic
Hospital
Dispensary
Ambulance
Insane Asylum
Bedlam
Gheel
Epileptic Colony
Vital Statistics
Sanitary Laws
Health, Boards of
Contagious Diseases
Hippocratic Oath
Medical Code

Malpractice
Medicine

II. ANATOMY AND PHYSIOLOGY.

1. *General Articles:*

Anatomy
Physiology

2. *Bones, Muscles, and Ligaments:*

Bone
Cartilage
Marrow
Periosteum
Suture
Ossification
Skeleton
Skull
Spinal Column
Rib
Sternum

- | | |
|-------------------------------------|----------------------------------|
| Muscle and Muscular Tissue | Trachea |
| Tendon | Bronchus |
| Ligament | Asphyxia |
| Flesh | 7. Alimentary System: |
| Muscular Force | Alimentary System |
| Diaphragm | Digestion, Organs and Pro- |
| Joint | cesses of |
| Shoulder-Joint | Food |
| Arm | Nutrition |
| Hand | Teeth |
| Hip-Joint | Pharynx |
| Thigh | Salivary Gland |
| Knee-Joint | Œsophagus |
| Patella | Stomach |
| Leg | Pepsin |
| Foot | Intestine |
| 8. Cavities: | Peristaltic Motion |
| Skull | Pancreas |
| Chest | Pancreatin |
| Abdomen | Liver |
| Pelvis | Bile |
| 4. Nervous System and Brain: | Brunner's Glands |
| Nervous System and Brain | Absorption |
| Cerebro-Spinal Fluid | Colon |
| Inhibition | Cæcum |
| 5. Circulatory System: | Vermiform Appendix |
| Circulation | Rectum |
| Heart | Anus |
| Vein | Fæces |
| Artery | 8. Genito-Urinary System. |
| Pulse | Puberty |
| Aorta | Menstruation |
| Innominate Artery | Climacteric Year |
| Carotid Artery | Reproduction |
| Iliac Arteries | Ovary |
| Blood | Fallopian Tubes |
| Blushing | Uterus |
| 6. Respiratory System: | Vagina |
| Respiration, Organs and Pro- | Bartholin's Glands |
| cess of | Breast |
| Pharynx | Kidney |
| Larynx | Ureter |
| Voice | Bladder |

- Urethra
 - Urine
 - 9. *Special Senses:*
 - Nose
 - Eye
 - Ear
 - Tongue
 - Touch
 - 10. *Ductless Glands and Lymphatic Structures:*
 - Thyroid Gland
 - Thymus Gland
 - Suprarenal Capsules
 - Pituitary Body
 - Spleen
 - Tonsil
 - Lymphatic
 - Thoracic Duct
 - Lacteal
 - Chyle
 - Lymph
 - 11. *Tissues:*
 - Histology
 - Epithelium
 - Gland
 - Skin
 - Hair
 - Sweat
 - Nail
 - Scalp
 - Membrane
 - Mucous Membrane
 - Connective Tissue
 - Adipose Tissue
 - Endothelium
 - Serous Membrane
 - Pericardium
 - Pleura
 - Mesentery
 - Peritoneum
 - Periosteum
 - Muscle and Muscular Tissue
 - Nervous System and Brain
 - 12. *Embryology:*
 - Embryology, Human
 - Epigenesis
 - Embryo
 - Fœtus
 - 13. *Physiological Subjects not included Above:*
 - Chemistry, Physiological
 - Life, Mean Duration of
 - Rigor Mortis
 - Longevity
 - Metabolism
 - Animal Heat
 - Temperature of the Body
 - Sleep
 - Hypnoscope
 - Sex
 - Sensation
 - Secretion
 - Vivisection
 - Vegetarianism
- III. HYGIENE AND PROPHYLACTIC METHODS.
- Hygiene
 - Sanitary Laws
 - Sanitary Science
 - Health
 - Immunity
 - Quarantine
 - Disinfectants
 - Heating and Ventilation
 - Water Supply
 - Water Purification
 - Sewage Disposal
 - Food
 - Diet
 - Infants, Feeding of
 - Wine
 - Sterilized Food
 - Exercise
 - Physical Training
 - Bath
 - Vaccination

IV. PATHOLOGY AND THERAPEUTICS.

1. *General Articles:*

Pathology
Therapeutics
Disease
Nosology
Disease, Germ Theory of
Distribution of Diseases
Congenital Disease
Degeneration
Intermarriage
Filth Disease
Occupational Diseases
Endemic
Epidemic
Infection
Insects, Propagation of Disease
by
Bacteria
Microscopy, Clinical
Toxin
Virus
Homœopathy
Eclectic School of Medicine
Christian Science
Osteopathy
Leeching

2. *Specific Infectious Diseases:*

Typhoid Fever
Relapsing Fever
Smallpox
Chicken Pox
Scarlet Fever
Measles
Mumps
Whooping Cough
Influenza
Dengué
Meningitis
Erysipelas
Diphtheria
Croup
Septicæmia

Poliomyelitis
Cholera
Yellow Fever
Black Vomit
Plague
Dysentery
Malaria and Malarial Fever
Ague
Jungle Fever
Malignant Pustule
Anthrax
Intermittent Fever
Remittent Fever
Hydrophobia
Tetanus
Trismus Nascentium
Syphilis
Tuberculosis
Scrofula
Glanders
Actinomycosis
Febricula
Malta Fever

3. *Constitutional Diseases:*

Rheumatism
Lumbago
Gout
Diabetes
Rickets
Scurvy
Purpura
Hæmophilia
Obesity

4. *Diseases of the Alimentary System:*

Mouth, Diseases of the
Aphthæ
Pharyngitis
Quinsy
Œsophagus
Stomach, Diseases of the
Gastritis
Dyspepsia

Indigestion
Enteritis
Gastro-Enteritis
Cholera Infantum
Mesentery
Liver, Diseases of the

5. Diseases of the Respiratory System:

Rhinitis
Hay Fever
Laryngitis
Bronchitis
Asthma
Tuberculosis
Pneumonia
Pleurisy
Hydrothorax

6. Diseases of the Circulatory System:

Heart, Diseases of the
Pericarditis
Endocarditis
Myocarditis
Palpitation
Angina Pectoris
Atheroma
Arterio-Sclerosis

7. Diseases of the Blood and Ductless Glands:

Anæmia
Chlorosis
Leucocythæmia
Goitre
Cretinism
Myxædema
Basedow's Disease
Acromegaly
Addison's Disease

8. Diseases of the Kidneys:

Kidney, Diseases of the
Bright's Disease
Uræmia

9. Diseases of the Nervous System and Brain:

Neurology
Nervous Disease
Nervousness
Paralysis
Neuritis
Sciatica
Facial Paralysis
Caisson Disease
Myelitis
Locomotor Ataxia
Syringomyelia
Brain, Diseases of the
Aphasia
Apoplexy
Hemiplegia
Hydrocephalus
Paralysis Agitans
Chorea
Epilepsy
Hystero-Epilepsy
Migraine
Neuralgia
Facial Neuralgia
Neurosis
Hysteria
Sea-Sickness
Neurasthenia
Hypochondriasis
Rest-Cure
Acromegaly
Stammering
Nostalgia
Fatuity
Imbecility
Idiocy
Insanity
Delirium
Dipsomania
Melancholia
Mania
Paranoia
Pellagra

Monomania
Pyromania
Kleptomania
Homicidal Mania
Puerperal Insanity
Paresis
Lucid Interval
Imitative Insanity

10. *Parasitic Diseases:*

Parasitic Diseases
Worms
Oxyuris
Trichiniasis
Sleeping-Sickness
Filaria
Lumbricoid
Tapeworm

11. *Symptoms and Morbid Conditions:*

Albuminuria
Amblyopia
Amenorrhœa
Anosmia
Aphonia
Arcus Senilis
Asthenopia
Bedsores
Breath, Offensive
Cachexia
Catalepsy
Catarrh
Colic
Coma
Congestion
Constipation
Convulsion
Coughing
Cramp
Crisis
Cyanosis
Degeneration
Diarrhœa
Dropsy

Ecchymosis
Embolism
Epistaxis
Fainting
Fatty Degeneration
Fever
Formication
Hæmaturia
Hæmoptysis
Headache
Heat-Stroke
Hectic Fever
Hemiopia
Hiccough
Hyperæsthesia
Hypertrophy
Insomnia
Jaundice
Knee-Jerk
Leucorrhœa
Locomotor Ataxia
Muscæ Volitantes
Nausea
Œdema
Osteomalacia
Oxaluria
Papule
Pectoriloquy
Petechia
Pleurodynia
Polydipsia
Pulse
Purpura
Pyrosis
Respiratory Sounds
Senility
Sitophobia
Skin Disease
Spasm
Starvation
Sweat
Symptom
Tenesmus
Thirst

Tinnitus Aurium
 Urine, Incontinence of
 Vertigo
 Vomiting
 Waxy, or Amyloid Degeneration

12. *Diagnostic and Therapeutic Methods and Instruments:*

Diagnosis
 Percussion
 Auscultation
 Stethoscope
 Dynamometer
 Axillary Thermometer
 Temperature of the Body
 X-Rays
 Microscopy, Clinical
 Laryngoscope
 Ophthalmoscope
 Therapeutics
 Diet
 Exercise
 Movement Cure
 Hydrotherapy
 Massage
 Rest-Cure
 Transfusion of Blood
 Venesection
 Radium

V. SURGERY, GYNÆCOLOGY, AND OBSTETRICS.

1. *General Articles:*

Surgery
 Surgery, Military
 Obstetrics

2. *General Surgical Pathology:*

Inflammation
 Suppuration
 Pus
 Abscess
 Boil
 Felon
 Carbuncle
 Ulcer

Phagedena
 Sinus
 Fistula
 Necrosis
 Gangrene
 Caries
 Adhesion
 Cicatrization
 Bruise
 Wound
 Gunshot Wound
 Dissection Wounds
 Burns and Scalds
 Frostbite
 Tumor
 Cyst
 Hydatid
 Actinomycosis
 Adenitis
 Septicæmia
 Pyæmia
 Shock

3. *General Surgical Technique:*

Anæsthesia
 Antiseptic
 Acupressure
 Acupuncture
 Bleeding
 Drainage Tubes
 Ligature
 Suture
 Tourniquet
 Puerperal Fever
 Abortion
 Forceps
 Embryotomy
 Cæsarean, or Cæsarian, Operation
 Leeching
 Electricity, Medical Uses of
 Compressed-Air Treatment
 Respiration, Artificial
 Resuscitation
 Stomach-Pump
 Cupping

- Organotherapy
- Serum Therapy
- Antitoxin
- Tuberculin
- Hypnotism
- Hypodermic Medication
- 4. *Pathology of Special Structures:*
 - Artery
 - Aneurism
 - Phlebitis
 - Varicose Vein
 - Thrombosis
 - Embolism
 - Nerve-Stretching
 - Fracture
 - Callus
 - Osteomyelitis
 - Periostitis
 - Splint
 - Amputation
 - Sprain
 - Synovitis
 - Arthritis
 - Housemaid's Knee
 - Ankylosis
 - Dislocation
 - Resection
 - Wen
 - Keloid
 - Chapped Hands
 - Bunion
 - Corn
 - Skin-Grafting
- 5. *Orthopædic Surgery:*
 - Deformities
 - Wry-Neck
 - Pott's Disease
 - Spine, Curvature of the
 - Hip-Joint
 - Knock-Knee
 - Leg
 - Valgus
 - Varus
 - Clubfoot
- Tenotomy
- Artificial Limbs
- 6. *Regional Surgery, Including Gynecology:*
 - Encephalocele
 - Concussion of the Brain
 - Trephine, Trephining
 - Rhinoplastic Operation
 - Harelip
 - Ranula
 - Dentistry
 - Laryngotomy
 - Tracheotomy
 - Choking
 - Mammary Gland, Diseases of
 - Rib, Fracture of the
 - Pleurisy
 - Empyema
 - Peritonitis
 - Gastrostomy
 - Umbilical Hernia
 - Hernia
 - Truss
 - Intussusception
 - Laparotomy
 - Vermiform Appendix
 - Perityphlitis
 - Ovary
 - Nephrotomy
 - Nephrectomy
 - Calculus, or Stone
 - Lithotrity
 - Lithotomy
 - Castration
 - Rectum, Diseases of the
 - Prolapsus Ani
 - Piles
 - Spina Bifida
 - Uterus, Diseases of the
 - Prolapsus Uteri
- 7. *Obstetrics:*
 - Obstetrics
 - Gestation
 - Superfœtation and Superfecundation

Placenta
Puerperal Fever
Caul
Umbilical Cord
Meconium
Weaning
Agalactia

**VI. DISEASES OF THE NOSE AND
THROAT, EAR, EYE, SKIN, AND
THE GENITO-URINARY SYS-
TEM.**

1. Diseases of the Nose and Throat:

Rhinitis
Epistaxis
Ozena
Polypus
Throat, Affections of the
Larynx, Diseases of the
Laryngitis

2. Diseases of the Ear:

Ear
Deafness
Cerumen
Otitis Media
Otorrhœa
Otalgia

3. Diseases of the Eye:

Eye, Diseases of the
Blindness
Ectropion
Entropion
Stye
Trichiasis
Conjunctivitis
Ophthalmia
Blepharitis
Cornea
Leucoma
Staphyloma
Iritis
Glaucoma
Cataract
Retinitis
Nyctalopia

Color-Blindness
Optic Neuritis
Sight, Defects of
Myopia
Hyperopia
Astigmatism
Heterophoria
Strabismus

4. Diseases of the Skin:

Acarus Folliculorum
Acne
Alopecia
Bromidrosis
Corn
Ecthyma
Eczema
Erythema
Favus
Hair
Ichthyosis
Impetigo
Itch
Leprosy
Lichen
Lupus
Nævus
Pemphigus
Pityriasis
Plica
Prurigo
Psoriasis
Ringworm
Rupia
Seborrhœa
Sycosis
Tinea
Vitiligo
Wart
Yaws

**5. Diseases of the Genito-Urinary
System:**

Cystitis
Calculus, or Stone
Extravasation

Prostate Gland
Gonorrhœa
Stricture
Hydrocele
Varicocele
Syphilis
Circumcision

VII. MATERIA MEDICA.

1. *General Articles:*

Materia Medica
Pharmacopœia
Toxicology
Prescription

2. *Preparation of Drugs:*

Tincture
Pill
Liniment
Lotion
Plasters
Infusion
Extract
Percolation
Suppository
Unguent
Ointment
Elixir

3. *Classification of Drugs:*

Alterative
Tonic
Excitant
Narcotics
Sedatives
Hypnotics
Anæsthetic
Anodyne
Antipyretic
Febrifuge
Expectorant
Stimulants
Gargle
Emetics
Anti-Emetic
Bitters

Antacids
Carminatives
Cholagogue
Laxative
Purgatives
Cathartic
Hydragogues
Anthelmintic
Diuretics
Diaphoretics
Anhidrotics
Antispasmodic
Astringents
Demulcents
Diluents
Aphrodisiac
Anaphrodisiacs
Emmenagogues
Oxytocics
Irritant
Rubefacients
Refrigerants
Depilatories
Disinfectants
Poison
Antidote

4. *Drugs:*

Quinine
Mercury, Medicinal uses of
Iodine
Iodides
Bromides
Arsenic
Iron
Colchicum
Colchicine
Salicylic Acid
Salicylates, Medical Uses of the
Salicin
Sulphur, Medical Uses of
Fern, Male
Kamala
Santonin
Goa Powder

- | | |
|--|------------------------|
| Chrysarobin | Sodium |
| Phosphorus | Lime, or Calcium Oxide |
| Alcohol, Pharmacology, Toxicology, and Therapeutic Use | Apomorphine |
| Absinthe | Asafoetida |
| Hashish | Senna |
| Opium | Cascara Sagrada |
| Laudanum | Castor Oil |
| Paregoric | Blue Pill |
| Dover's Powder | Calomel |
| Morphine | Rhubarb |
| Chloral | Aloes |
| Paraldehyde | Seidlitz Powders |
| Hypnal | Rochelle Salt |
| Sulphonal | Epsom Salt |
| Trional | Jalap |
| Urethane | Colocynth |
| Hemlock | Elaterin |
| Coniine | Bismuth |
| Curari | Lead |
| Chloroform | Lunar Caustic |
| Ether, or Di-Ethyl-Ether | Diuretin |
| Nitrous Oxide | Copaiba |
| Cocaine | Methylene Blue |
| Digitalis | Salol |
| Nux Vomica | Jaborandi |
| Strychnine | Iodoform |
| Strophanthus | Carbolic Acid |
| Valerian | Sulphurous Acid |
| Sparteine | Antipyrine |
| Aconite | Phenacetine |
| Hellebore | Acetanilid |
| Veratrine | Matzoon |
| Tobacco | Cod-Liver Oil |
| Amyl Nitrite | Lanolin |
| Nitroglycerin | Ichthyol |
| Belladonna | Salvarsan |
| Atropine | |
| Homatropine | |
| Sal Ammoniac | |
| Heroin | |
| Guaiacol | |
| Creosotol | |
| Calumba | |

VIII. HISTORY AND BIOGRAPHY.

1. History:

- Medicine
- Homœopathy
- Eclectic School of Medicine
- Anatomy
- Histology

Physiology
Hygiene
Pathology
Disease, Germ Theory of
Therapeutics
Surgery
Surgery, Military
Obstetrics
Dentistry

2. *Biography:*

Hippocrates
Galen, or Claudius Galenus
Aretæus
Avicenna
Linacre, or Lynaker, Thomas
Paracelsus
Fracastoro, Girolamo
Fallopio, or Fallopius, Gabriel
Vesalius, Andreas
Eustachio, Bartolommeo
Paré, Ambroise
Fabricius, or Fabrizio, Girolamo
Harvey, William
Sydenham, Thomas
Pecquet, Jean
Graaf, Regnier de
Willis, Thomas
Malpighi, Marcello
Radcliffe, John
Leeuwenhoek, Antonius van
Boerhaave, Hermann
Hoffmann, Friedrich
Sloane, Sir Hans
Morgagni, Giovanni Battista
Swieten, Gerard van
Haller, Albrecht von
Pott, Percival
Brown, John
Cullen, William
Hunter, John
Perkins, Elisha
Auenbrugger, von, or Auen-
brugg, Leopold

Mesmer, Franz, or Friedrich-
Anton
Bell, John
Jenner, Edward
Baillie, Matthew
Pinel, Philippe
Post, Wright
Gall, Franz Joseph
Soemmering, Samuel Thomas
von
Scarpa, Antonio
Spurzheim, Johann Kaspar
Hufeland, Christoph Wilhelm
Physick, Philip Syng
Broussais, François Joseph
Victor
Ling, Pehr Henrik
Esquirol, Jean Etienne Domi-
nique
Cooper, Sir Astley Paston
Larrey, Dominique Jean
Bell, Sir Charles
Hahnemann, Samuel
Dieffenbach, Johann Friedrich
Wells, Horace
Morton, Samuel George
Priessnitz, Vincenz
Beaumont, William
Orfila, Matthieu Joseph Bona-
venture
Graves, Robert James
Ennemoser, Joseph
Magendie, François
Warren, John Collins
Amussat, Jean Zuléma
Hall, Marshall
Bright, Richard
Müller, Johannes
Forbes, Sir John
Francis, John Wakefield
Wagner, Rudolph
Mott, Valentine
Quain, Jones
Lawrence, Sir William

Flourens, Marie Jean Pierre
Goodsir, John
Morton, William Thomas Green
Syme, James
Simpson, Sir James Young
Parrish, Edward
Holland, Sir Henry
Winslow, Forbes (Benignus)
Andral, Gabriel
Rokitansky, Karl, Baron
Bernard, Claude
Peaslee, Edmund Randolph
Long, Crawford W.
Wood, George Bacon
Taylor, Alfred Swaine
Seguin, Edouard Onesimus
Broca, Paul
Sims, James Marion
Parker, Willard
Gross, Samuel D.
Draper, John Christopher
Post, Alfred Charles
Flint, Austin
Kneeland, Samuel
Gray, John Perdue
Quain, Richard
Langenbeck, Bernhard Rudolph
von
Parker, Peter
Bright, Richard
Ricord, Philippe
Taylor, Isaac Ebenezer
Owen, Sir Richard
Earle, Pliny
Mackenzie, Sir Morell
Peters, John Charles
Moleschott, Jacob
Charcot, Jean Martin
Brown-Sequard, Charles Edouard
Pasteur, Louis
Tuke, Daniel Hack
Loomis, Alfred Lee
Dubois-Reymond, Emil Heinrich
Kneipp, Sebastian

Lusk, William Thompson
Quain, Sir Richard
Hart, Ernest Abraham
Pepper, William
Seguin, Edward Constant
Paget, Sir James
Taylor, Charles Fayette
Hammond, William Alexander
Virchow, Rudolph
Kussmaul, Adolph
Thomas, Theodore Gaillard
Davis, Nathan Smith
Thompson, Sir Henry
Esmarch, Johannes Friedrich
August von
Guernsey, Egbert
Lister, Sir Joseph
Emmet, Thomas Addis
Mitchell, Silas Weir
Jacobi, Abraham
Turner, Sir William
Recklinghausen, Friedrich von
Flint, Austin, Jr.
Smith, Andrew Heermance
Sternberg, George Miller
Carpenter, William Benjamin
Hansen, Gerard Henrik Armauer
Janeway, Edward Gamaliel
King, Albert Freeman Africanus
Wood, Horatio Curtis
Rayleigh, John William Strutt,
Baron
Koch, Robert
Laveran, Charles Louis Alphonse
Morton, William James
McBurney, Charles
Trudeau, Edward Livingston
Morselli, Enrico Agostino
Spitzka, Edward Charles
Lorenz, Adolph
Starr, Moses Allen
Horsley, Victor Alexander Haden
Peterson, Frederick
Manson, Patrick

Flexner, Simon
Ehrlich, Paul
Wassermann, August von
Carrel, A.
Sullstrand, Allwar
Tiedemann, Friedrich
Mayo, Charles Horace
Mayo, William James

Richet, C. R.
Kossel, Albrecht
Behring, E. A. von
Ross, Sir R.
Metchnikoff, E.
Ramón y Cajal, S.
Pavlov, I. P.
Finsen, N. R.

Chapter 33. Manners and Customs

Dress and Apparel

NOWHERE more than in the apparel of men and women does time wreak its changes and the spirit of an age stand out. The student of the manners and customs of a people or period often may apply himself with profit to a consideration of their garments, and conversely in a study of the garments reflex actions on the wearer may be observed. Indeed, clothes may be subject to the dictates of a fickle fashion or possess a spiritual and deep-lying significance, as in the case of ecclesiastical vestments, or changing from the decorative to the more serviceable, as in the case of the military or naval uniform.

Thus costume in itself may possess a significance more than merely for the interest of the votary of fashion. For such a student a series of articles might be recommended embraced in the following list:

Costume
Dress
Textiles
Dress Reform
Armor
Fashion
Embroidery
Corset
Crinoline
Girdle
Glove
Hosiery
Mantle
Shawl
Hair Dressing

Beard
Cosmetics
Rouge
Perfumery
Wig
Hat
Headdress
Shoes
Boots
Jewelry
Parasol
Uniforms, Military and Naval
Costume, Ecclesiastical
Degree (for Academic Costume)

Jewelry

Among the minor arts in none have there been more important developments than in the artistic design and fabrication of jewelry. In many fields there may be considered to have taken place within recent years a return to the artistic products of the early gold- and silver-smiths of Continental Europe, while in the cutting and setting of

gems there has also been opportunity for the display of the skill of the lapidary and the jeweler, who have evolved new styles of cutting and forms of settings.

Under the broad heading of **JEWELRY** in this section can be considered the articles for personal adornment, involving the use of precious and semi-

precious stones and the careful working of such metals as gold and silver, and also the manufacture of objects of utility and ornament of a somewhat larger description, such as tableware and the artistically decorated porcelain and other objects of art.

The visitor to a museum of fine arts would often find grouped in a single department such articles as are embraced in the following list, which is submitted for the guidance of the reader:

- Jewelry
- Fan
- Enamel
- Embossing
- Gems
- Goldsmith Work
- Inlaying
- Lacquer Work
- Lapidary Work
- Japanese Art
- Marquetry
- Metal Work
- Pearl
- Plate
- Porcelain
- Pottery
- Plated Ware
- Repousée
- Ring
- Stained Glass
- Table Ware
- Tarsia Work
- Fork
- Cutlery

In connection with jewelry, it is desirable to refer also to the various gems which are used for personal adornment. The article **GEMS**, which discusses the general qualities of precious or beautiful stones, with partic-

ular reference to those cut or engraved for use as jewels or seals, describes the history of such ornaments from the earliest periods of Egypt. This is followed by an article on **GEMS, IMITATION AND ARTIFICIAL**, in which are discussed the various imitations ranging all the way from crude affairs of glass to modern triumphs of the chemist, involving the electric furnace as a means of producing the gems artificially or synthetically.

While precious stones used for gems may have considerable value, due to their rare occurrence in nature, it is the lapidary who, in his cutting, grinding and polishing the various crystals or other precious stones, adds to their value or even, in some cases, gives beauty and value to stones whose intrinsic value is but small. Accordingly, the article **LAPIDARY WORK** should be read in addition to that on gems, and then the reader can take up the series of articles on the precious stones themselves—naturally headed by the diamond. These arrange themselves into two groups—those of great rarity and value, as follows:

- Diamond
- Emerald
- Ruby
- Sapphire
- Amethyst
- Opal
- Carnelian
- Turquoise
- Topaz

The second group comprises many, mostly crystalline minerals, that are also considered as precious, but whose rarity is not such as to put them in

the same class with the list just given.

Such minor stones would be:

Corundum

Quartz

Beryl

Chrysoberyl

Aquamarine

Tourmaline

Alabaster

Chalcedony

Sardonyx

Argonite

Agate

Jasper

Chrysolite

Garnet

Rhodonite

Chrysocolla

Catlinite

Chapter 34. Games and Sports

ALL peoples indulge in exercises of strength, of skill, of bodily and mental agility, or of fortune, and often these mimic the more serious pursuits of life, or consist in these very pursuits indulged in for pleasurable purposes only.

1. The capture and slaying of animals has remained a source of pleasure long after it has ceased to be the chief business of life. See:

- (a) Shooting
- Archery
- Trapping
- Coursing
- Battue
- Tiger-hunting
- Still-Hunting
- Fox-hunting
- Falconry
- Game Laws
- Game Preserves

- (b) Angling
- Bait-fishing
- Salmon-fishing
- Trolling
- Trout-fishing
- Fly-Casting

2. The mimicry of war is also found in contests between men or animals, or men and animals. See:

- Pugilism
- Boxing
- Wrestling
- Fencing
- Cock-fighting
- Bear-baiting
- Bull-fight

3. Water, both in its common state and in the forms of ice and snow, furnishes many forms of sport to primitive and civilized man. See:

- (a) Swimming
- Rowing

Canoe and Canoeing
Yachting
Water Polo

- (b) Skating
- Ice Polo
- Ice Yachting
- Curling

- (c) Snowshoeing
- Skiing

4. Useful to man in labors, the horse is his great companion in numerous sports. See:

Horsemanship
Coaching
Driving
Trotting
Pacing
Horse-racing
Stud-book
Derby Day
Steeple chasing
Polo
Hippodrome

5. Of the instruments entering into popular games, the ball, in various shapes, is by far the most common and the most widespread. See:

Bowls
Baseball
Indoor Baseball
Cricket
Golf
Croquet
Hockey
La Crosse
Polo
Football

Basketball
 Handball
 Pelota
 Racquets
 Tennis
 Lawn Tennis
 Court Tennis
 Ping-Pong
 Billiards
 Bagatelle

6. In games of chance, the card and the die in varying forms are universally found. In the case of cards, however, chance often plays the minor part and the game assumes a highly intellectual character. See:

- (a) Cards
 Whist
 Bridge
 Pinochle
 Skat
 Ecarté
 Piquet
 Bezique
 Cribbage
 Euchre
 Solitaire
 Poker
 Baccarat
 Rouge et Noir
 Fan-tan
 (b) Dice
 Hazard

Craps

(c) Roulette

7. For the great intellectual games par excellence, see:

Chess
 Checkers
 and for cognate games:
 Backgammon
 Dominoes

8. Miscellaneous sports and games:

Cycling
 Mountain Climbing
 Coasting
 Toboggan
 Shuffleboard
 Quoits

9. The general subject is treated under:

Athletics
 Gymnastics
 Physical Culture
 Amateur
 Handicapping
 Sports, Book of
 Games, Ancient
 Gymkhana
 Olympic Games
 Pythian Games
 Nemea
 Gladiator
 Circus
 Acrobat

